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TEAM MODELLING: SURVEY OF EXPERIMENTAL PLATFORMS

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Abstract

Defence Research and Development Canada (DRDC) Toronto is in the process of developing a team research platform aimed at supporting the Canadian Forces (CF) future integrated operations, and interoperability with allies, other government departments (OGDs) and non-government organizations (NGOs). A literature review of platforms for team research was conducted to support the Crown in choosing a specific type of team in a specific work context as the focus of team research and team modelling to be conducted in a multi-year Applied Research Project (ARP). The objectives of this report were to identify and characterize different team research platforms in support of military operations (or related applications), review the different team research platforms in terms of criteria identified by the team literature review; and identify requirements for a new experimental platform that will support experiments that are representative of the targeted teamwork context. In addition, correlations were established with the literature review that was also conducted in the first phase of this project (Sartori, Waldherr and Adams, 2006), to identify areas that are relatively unexplored in both the literature and platform review.

A series of publicly available literature databases and other readily accessible sources of information were searched based on specified keywords for the platform literature review. This review proved to be a valuable task to produce recommendations for a new team research platform. This was achieved by identifying commonalities and unique features between the capabilities of different types of platforms. From the main findings of this study, it was concluded that the new team research platform should: support the following team types – ad hoc, interdisciplinary, interagency, joint, distributed and teams-of-teams, be medium fidelity, be a virtual simulation with some constructive capabilities, use an operational/strategic level of activity, use small team sizes, address team diversity, address different types of workload (physical, cognitive, and time pressure), be amenable to upgrades and future expansions (open architecture), address and measure team processes such as shared knowledge, communication, and planning, be amendable to the study of individual performance or behaviour, be amenable to customization of the interface, have the capability to manipulate task loads, and have the capability to create a user-defined environment.

Résumé

Recherche et développement pour la défense Canada (RDDC) de Toronto est à mettre au point une plate-forme de recherche sur les équipes dans le but d'appuyer les opérations intégrées futures des Forces canadiennes (FC), et d'en assurer l'intéropérabilité avec les alliés, les autres ministères et les organisations non-gouvernementales (ONG). L'organisme a effectué une analyse documentaire des ouvrages traitant de plates-formes pour la recherche sur les équipes afin d'aider l'État à choisir un type spécifique d'équipe dans un contexte de travail particulier comme objet des recherches et de la modélisation qui seront effectuées dans le cadre d'un projet pluriannuel de recherche appliquée (PRA). Le présent compte rendu vise à définir et à caractériser les différentes plates-formes de recherche sur les équipes pour appuyer les opérations militaires (ou des applications connexes), à en faire l'examen en regard des critères isolés par suite de l'analyse documentaire et à indiquer les exigences auxquelles la nouvelle plate-forme expérimentale devra satisfaire afin d'autoriser des expériences qui seront représentatives du contexte du travail d'équipe ciblé. Des liens ont également été établis avec l'analyse documentaire qui a été effectuée dans la première phase du projet (Sartori, Waldherr et Adams, 2006) dans le but de déterminer les domaines qui demeurent relativement inexplorés tant dans les ouvrages dépouillés que dans les plates-formes étudiées.

Dans le cadre de l'analyse documentaire, on a scruté des bases de données sur les ouvrages accessibles au public et d'autres sources d'information facilement accessibles en utilisant des mots-clés spécifiques. Cet examen s'est avéré utile pour formuler des recommandations sur la nouvelle plate-forme de recherche sur les équipes. À cette fin, on a déterminé les caractéristiques communes et uniques des fonctions des différents types de plate-forme et d'après les principales observations de l'étude, on a conclu que la nouvelle plate-forme de recherche devait présenter les caractéristiques suivantes : capable d'autoriser les recherches sur les équipes spéciales, interdisciplinaires, inter-agences, conjointes et réparties ainsi que sur les équipes d'équipes, être à fidélité moyenne, être une simulation virtuelle avec quelques capacités constructives, utiliser un niveau d'activité opérationnel et stratégique, utiliser des tailles réduites d'équipe, aborder la question de la diversité des équipes, traiter différents types de charge de travail (matérielle, cognitive et contraintes dans le temps), capable d'être mise à niveau et agrandie (architecture ouverte), absorber et mesurer les processus collectifs comme le partage des connaissances, la communication et la planification, autoriser l'étude du rendement ou le comportement individuel, autoriser la personnalisation de l'interface, être capable d'absorber de grosses charges, et de créer un environnement défini par l'utilisateur.

Executive Summary

Defence Research and Development Canada (DRDC) Toronto is in the process of developing a team research platform aimed at supporting the Canadian Forces (CF) future integrated operations, and interoperability with allies, other government departments (OGDs) and non-government organizations (NGOs). To support the development of a platform for team research, DRDC Toronto is studying the existing literature on teams and team research platforms. The review will support the Crown in choosing a specific type of team in a specific work context as the focus of team experiments and team modelling to be conducted in a multi-year Applied Research Project (ARP).

The objectives of this report were to identify and characterize different team research platforms in support of military operations (or related applications), review the different team research platforms in terms of criteria identified by the team literature review; and identify requirements for a new experimental platform that will support experiments that are representative of the targeted teamwork context. A series of publicly available literature databases and other readily accessible sources of information were searched based on specified keywords. In order to satisfy the requirements of this project, the literature had to: (1) make reference to a research platform for running team experiments, (2) provide a description of the platform, and (3) meet one or more of these team type criteria— ad hoc, interdisciplinary, interagency, joint, distributed, and teams-of-teams. In addition, from the results obtained from the Sartori et al (2006) report, a mapping was developed to demonstrate the platform's correlation to the findings of the team modelling literature review. This was done in an effort to synthesize the results to identify areas that are relatively unexplored in both the reviewed literature and platforms.

The review of platforms proved to be a valuable task. It generated a number of recommendations that should be considered as requirements for a new team experimental platform. Specifically, the new platform should:

- Support operational and/or strategic level(s) of activity;
- Support mission planning and rehearsal for operational and/or strategic levels scenarios;
- Use a small team size;
- Be suitable for use by ad hoc teams;
- Be suitable for use by interdisciplinary teams;
- Be suitable or adaptable for use by of teams-of-teams;

In terms of experimental capabilities, the new platform should:

- Be amenable to the study of individual performance or behaviour;
- Permit the manipulation and measurement of different types of workload, including: physical, cognitive, and time pressure, as well as different levels of workload.
- Permit the manipulation and measurement of team processes, such as shared knowledge, communication, planning, and coordination.

- Permit the comparison of multiple teams through the measurement and comparison of the same processes and outcomes on the same scenario or task;
- Support the investigation of team diversity, from surface level diversity (age, gender, etc.) to the inclusion of joint and interagency team members.

In terms of technical capabilities, the new platform should:

- Be a medium fidelity simulation, to achieve an ideal balance between realism and experimental control;
- Be a virtual simulation with some constructive capabilities, to enable direct comparison of human to agent performance;
- Be a distributed simulation;
- Provide a control system, to permit the assignment of specific (subsets of) objects to the control of specific (or all) player(s);
- Provide multiple communication channels (e.g., message board, chat/type, radio, face-to-face, etc.) between the distributed parties, and permit customization of the communication channels and frequency based on experimental aims;
- Be amenable to upgrades and future expansions, using an open architecture that will enable the platform to interact with other platforms;
- Be capable of changing the level of interaction over multiple (joint) platforms.

Sommaire

Recherche et développement pour la défense Canada (RDDC) de Toronto est à mettre au point une plate-forme de recherche sur les équipes dans le but d'appuyer les opérations intégrées futures des Forces canadiennes (FC), et d'en assurer l'intéropérabilité avec les alliés, les autres ministères et les organisations non-gouvernementales (ONG). Dans le but d'appuyer la mise au point d'une telle plate-forme, RDDC de Toronto étudie les ouvrages qui traitent du sujet des équipes et des plates-formes de recherche sur les équipes. Cet examen aidera l'État à choisir un type spécifique d'équipe dans un contexte de travail particulier comme objet des expériences sur les équipes qui seront effectuées dans le cadre d'un projet pluriannuel de recherche appliquée (PRA).

Le présent compte rendu vise à définir et à caractériser les différentes plates-formes de recherche sur les équipes pour appuyer les opérations militaires (ou des applications connexes), à en faire l'examen en regard des critères isolés par suite de l'analyse documentaire et à indiquer les exigences auxquelles la nouvelle plate-forme expérimentale devra satisfaire afin d'autoriser des expériences qui seront représentatives du contexte du travail d'équipe ciblé. On a scruté des bases de données sur les ouvrages accessibles au public et d'autres sources d'information facilement accessibles en utilisant des mots-clés spécifiques. Les ouvrages consultés devaient satisfaire aux conditions suivantes : 1) parler d'une plate-forme de recherche pour les expériences sur les équipes, 2) fournir la description de la plate-forme, et 3) satisfaire à un ou à plusieurs critères définissant les types d'équipes — spéciales, interdisciplinaires, inter-agence, conjointes, réparties et équipes d'équipes. En outre, on a dessiné à partir des résultats de Sartori et al (2006) un graphique montrant la corrélation entre la plate-forme et les conclusions du dépouillement d'ouvrages traitant de modélisation d'équipes. Cet exercice avait pour but de mettre en rapport les résultats afin de déterminer les domaines qui demeurent relativement inexplorés tant dans les ouvrages dépouillés que dans les plates-formes étudiées.

L'examen des plates-formes s'est avéré utile en permettant de formuler un certain nombre de recommandations à prendre en compte au titre de critères à appliquer à la nouvelle plate-forme de recherche expérimentale sur les équipes, notamment :

- Capacité d'appuyer les activités opérationnelles et stratégiques;
- Capacité d'appuyer la planification des missions et la répétition des scénarios de niveau opérationnel et/ou stratégique;
- Utilisation de tailles réduites d'équipe;
- Être utilisable par des équipes spéciales;
- Être utilisable par des équipes interdisciplinaires;
- Être utilisable par des équipes d'équipes;

Sur le plan des fonctions expérimentales, la nouvelle plate-forme devrait présenter les caractéristiques suivantes :

- Autoriser l'étude du comportement ou du rendement individuel;

- Permettre le traitement et la quantification des charges de travail, y compris, sur les plans matériel et cognitif, et les contraintes de temps, de même que les différents niveaux de la charge de travail.
- Permettre le traitement et la quantification des processus collectifs, comme le partage des connaissances, la communication, la planification et la coordination.
- Permettre de comparer plusieurs équipes en mesurant et en comparant les mêmes processus et les résultats obtenus avec le même scénario ou la même mission;
- Appuyer l'étude de la diversité des équipes, de la diversité superficielle (âge, sexe, etc.) à l'inclusion des membres des équipes conjointes et inter-agences.

Sur le plan des capacités techniques, la nouvelle plate-forme devrait présenter les caractéristiques suivantes :

- Être une simulation à fidélité moyenne, afin d'atteindre l'équilibre idéal entre le réalisme et le contrôle expérimental;
- Être une simulation virtuelle avec quelques fonctions constructives afin de permettre la comparaison directe du rendement de l'homme et de l'agent;
- Être une simulation répartie;
- Offrir un système de contrôle pour permettre l'assignation d'objets spécifiques (ou sous-ensembles d'objets) au contrôle de certains joueurs (ou de tous);
- Offrir de multiples canaux de communication (p. ex., babillard, clavardage, radio, de personne à personne, etc.) entre les parties éloignées et permettre la personnalisation des canaux de communication et de la fréquence selon les buts expérimentaux;
- Avoir la capacité d'être mise à niveau et agrandie grâce à son architecture ouverte qui lui permettra d'interagir avec d'autres plates-formes;
- Avoir la capacité de modifier le niveau d'interaction de multiples plates-formes (conjointes).

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1. Introduction

Defence Research and Development Canada (DRDC) Toronto is in the process of developing a team research platform aimed at supporting the Canadian Forces (CF) future integrated (rather than air, maritime, or land-only) operations, and interoperability with allies, with other government departments (OGDs) and with non-government organizations (NGOs). To support the development of a platform for running team experiments, DRDC Toronto is studying the existing literature on teams and team research platforms used around the world and the manner in which they are implemented. The review will support the Crown in choosing a specific type of team in a specific work context as the focus of team experiments and team modelling to be conducted in a multi-year Applied Research Project (ARP). DRDC Toronto can apply this understanding to the development of a team research platform that adds to the existing corpus of knowledge about teams, and builds upon the best aspects of the extant platforms while avoiding known deficiencies with these systems. The direction of this work corresponds to the DRDC Science and Technology (S&T) challenge areas PS-3: Strategies for promoting collaborative behaviour among teams, agencies, organisations and societies; and HU-2: Human systems integration.

In pursuit of this information, DRDC Toronto is sponsoring four related streams of work:

1. Conduct a literature review on teams;
2. Conduct a review into existing platforms for running team experiments;
3. Evaluate and critique team research scenarios; and,
4. Review projects from around the world describing computational models of teams.

The current contract addresses the latter three work items and has been contracted to Human*systems* Incorporated® as contract no. W7711-047911. This report reflects work stream 2: the review of existing experimental platforms for team research. The Scientific Authority (SA) for this work is Renee Chow.

1.1 Objectives

The stated objectives of this contract are threefold:

1. Identify and characterize different team research platforms in support of civilian and military operations;
2. Review the team research platforms in terms of criteria identified by the team literature review; and,
3. Identify requirements for a new experimental platform that will support experiments that are representative of the targeted teamwork context.

This particular phase of work focused on producing a literature review of team research platforms. In order to achieve this, the following objectives were met:

1. Select the most relevant platforms (from a previous literature review (Sartori et al., 2006) and supplemental searches);
2. Review the literature;

3. Describe strengths and weaknesses of the existing platforms and complete one profile for each platform;
4. Write a literature review about the team research platforms.

An exhaustive bibliographic list and associated literature review was produced under a separate contract (Sartori et al, 2006), but was used extensively to shape this report. In particular, platforms and team process factors uncovered by that report were drawn upon to conduct this work (see Annex C). The bibliographic listing will not be replicated in full in this report. This report outlines the approach to searching for literature and reading the obtained literature, the dimensions used for the table describing existing platforms, and the literature review itself. Some conclusions and recommendations are made.

Task 1 of this contract was the survey of experimental platforms. The purpose of this survey was to support the specification of a new team research platform. This survey of existing platforms focused on team research platforms that represent the military or related applications including:

- Emergency planning and/or management
- Emergency services management
- Intelligence analysis

Strengths and weaknesses were assessed for each platform. The result from this analysis formed recommendations for a new team modelling research platform that will accommodate the CF's needs and provide a reasonable balance between experimental control and simulator fidelity.

2. Method

A brainstorming session was held to identify keywords and keyword combinations for searching the publicly available literature databases and other readily accessible sources of information.

2.1 Keywords and Approach

The following keywords (Table 1) were used in combination to search easily accessible databases. The words were used in combination (one word from primary, then one word from secondary would be added, then one word from tertiary would be added until all combinations of primary with secondary with tertiary words are searched). If an unmanageable number of hits results from a search with three words, additional modifiers (from the keyword list) would be used to focus the results.

Table 1: Primary, secondary and tertiary keywords for searching for types of team research literature

Primary Keywords	
Modelling	
Research	
Performance	
Platform	
Simulation	
Secondary Keywords	
Distributed	
Ad hoc	
Interdisciplinary	
Interagency	
Joint	
Operational	
Strategic	
System	
Tertiary Keywords	
Memory	Air
Cognition	Maritime
Cognitive	Land
Distributed	Common
Workload	Joint
Efficiency	Combined
Communication	Radar
Scenario	C2
Environment	C3
Military	C4ISR
Navy	Facility
Nuclear	Lab
Medical	Organization

These keywords (above) were used to search the following international databases:

ACM
AFRL
Air Command and Staff College
CF Staff College Library
CISTI
DSTO
DTIC
Ergonomics Abstracts
Eurocontrol
FAA
IEEE
NATO Research and Technical Organisation
Naval Postgraduate School
NC3A
NTIS
ONERA
PsychLit
Qintetiq
RMC Library
Royal Military College of Science (Shrivenham)
USAF Academy

Additionally, the following team research terms were used to search the above databases and the internet. They were searched as single (indivisible) terms:

Emergency Services
Incident Managers
Command and Control
Force Agility
Shared Situational Awareness
Attentional Demand
Interoperability
Network Based Operations
Effect Based Operations
Speed of Command
Self Synchronization
Reach Back
Reach Forward
Information Superiority
Increased Mission Effectiveness

2.2 Assumptions Used to Select Platforms

The search of publicly accessible databases using the keyword combinations led to large numbers of potentially relevant literature. Accordingly, the following four criteria were used to reduce the number of relevant findings in the literature:

- The literature must make reference to a research platform for running team experiments;
- The literature must describe the platform and must meet one or more of the criteria in Annex B;
- The platform being described must support novel experimental design and experimental control;
- The platform being described must be capable of data collection and analysis.

These criteria were applied to the articles where possible. If platforms retrieved by the search did not satisfy these four criteria, they were omitted from this review.

2.3 Platform Search Results

The searches and filters above led to the rating of 44 platforms. Two team members, human factors professionals, read the literature in order to form first impressions which would also feed into the summary table of all platforms assessed, found in Annex B. Of these team members, one was a Subject Matter Expert (SME) with extensive knowledge of the workload modelling and simulation domain and experimental psychology. The other team member was a Systems Engineer, trained in modelling and simulation. Together, they reviewed all of the available literature to rate the relevance of each platform to the current research project.

To summarize the results of the platform literature search, a platform data sheet format was developed to record the results for each platform. The Platform Data Sheets are included in Annex A. Each data sheet gives a brief platform description, an operator/task description, and indicates the platform type (live, virtual, constructive), simulation fidelity (low, medium, high), team size, primary purpose of platform, and level of activity (tactical, operational, and/or strategic).

Also included in the data sheet are the following binary information (a “yes/no” determination):

- Ad Hoc
- Interdisciplinary
- Interagency
- Joint
- Distributed
- Teams-of-teams

The formal definitions used for these criteria can also be seen in Table 3.

In order to determine their relevance to team research, the platforms were judged against three sets of factors, in this order: a set of six criteria provided by the SA; the primary purpose of the

platform; and a set of additional criteria distilled from this survey. The process by which relevance was rated is illustrated in Figure 1; the factors considered are listed in Table 2 and defined in Table 3.

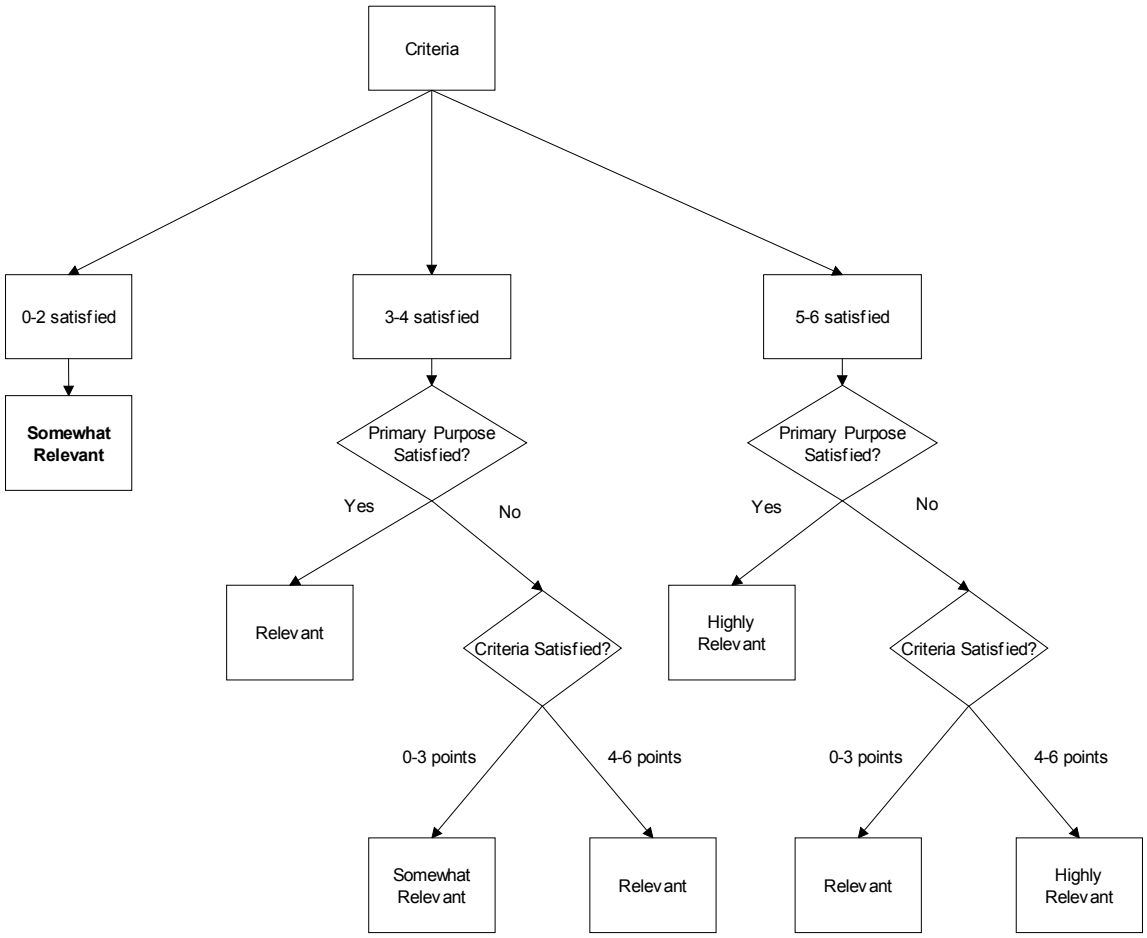

Figure 1: Platform Rating Process

Table 2: Factors Considered in Rating of Platforms

Set of factors	Constituent factors
SA-provided criteria	Ad hoc, interdisciplinary, interagency, joint, distributed, teams-of-teams
Primary purpose	Team research, other (e.g. team training)
Criteria distilled from this survey	Platform type (virtual, constructive, live), operational level (tactical, operational, strategic), fidelity (low, medium, high), team size (low, medium, high)

Table 3: Definitions of Factors

Term	Definition
Domain	Scope of the platform (ex. Air, Command and Control, Space, etc.)
Platform	Name of platform
Organization	The company or organization responsible for the creation of the platform. In some cases, the organization named is the primary user of the platform (not necessarily the creator).
Category	There were 3 categories: 1. **Live**: Full-up tests of systems or collections of systems in realistic environments. For example, they are field training or test exercises involving real hardware, troops, and or equipment in a battle simulation.. 2. **Virtual**: Computer models that represent the physical structure as well as behaviour of a product or entity. They may represent the product or entity behaviour at either high or low detail, but they are usually high fidelity (high-detail representations). Virtual simulations run in real time so the product's responses to human actions can be evaluated. 3. **Constructive**: Analytic models that can range from detailed engineering models to highly aggregated theatre simulations. Overall performance and/or behaviour of components, entities, systems, or collections of systems are predicted as a function of time and environmental stimuli. Some constructive simulations can include human-in-the-loop (such as war games and training module), however, they usually operate will no human interaction.
Level of Activity	Three levels of activity were possible as well as any combination of the three: 1. **Strategic**: Activities at this level establish national and multinational military objectives; sequence initiatives and therefore are conducted at the highest level of planning. 2. **Operational**: the level of activity where major operations are planned, conducted, and sustained to accomplish strategic objectives. 3. **Tactical**: the level at which battles and engagements are executed and planned to accomplish objectives assigned to tactical units or task forces.
Fidelity	There were 3 categories: 1. **Low**: a simulation in which participants are asked to perform tasks that represent abstractions of a subset of the total tasks required in the actual job environment. 2. **Medium**: a simulation in which participants are asked to perform tasks that represent faithful representations (e.g. in terms of physical and cognitive demands on the participant, environmental stressors, etc.) of a subset of the total tasks required in the actual job environment.

	3. **High**: a simulation in which participants are asked to perform all or most of the tasks expected in the actual job environment. The simulated task will impose the same demands upon the participants as it would in actual job performance.
Description	An overview of the platform's purpose and functionality.
Primary Purpose	The primary purpose of the platform's existence is to conduct team experiments as identified in Annex B as either "Yes" or "No". If the answer is No, then the primary purpose is identified, e.g. Training, testing, and planning. In Annex A (individual data sheets), the primary purpose is simply stated.
Relevance	The reader is referred to Figure 1: Platform Rating A platform was deemed **Highly Relevant** under the following conditions: 1. Five to six SA criteria satisfied, primary purpose satisfied. 2. Five to six SA criteria satisfied, primary purpose not satisfied, four to six points on survey factors. A platform was deemed **Relevant** under the following conditions: 1. Three to four SA criteria satisfied, primary purpose satisfied. 2. Five to six SA criteria satisfied, primary purpose not satisfied, less than four points on survey factors. 3. Three to four SA criteria satisfied, primary purpose not satisfied, four to six points on survey factors . A platform was deemed **Somewhat Relevant** under the following conditions: 1. Less than three SA criteria satisfied. 2. Three to four SA criteria satisfied, primary purpose not satisfied, less than four points on survey factors. In rating the platforms, "Yes" and "capable" were treated equally.
Ad Hoc	A team that is put together in response to a particular situation or problem (unplanned and may be opportunistic).
Interdisciplinary	A team that consists of members with distinct roles that may be based on individual training and education.
Interagency	A team involving two or more agencies, especially government agencies. Ex. RCMP, army, coast guard, or Non-government organizations (NGOs).
Joint	A team that consists of two or more members from different divisions within the military: air, land, or sea.
Distributed	A team that is geographically separate versus co-located.
Teams-of-teams	A team composed of two or more teams (sub-teams). For example, in an of Uninhabited Air Vehicle (UAV) ground control operations simulation, there could be three sub-teams within teams: 1. Air Vehicle Team (controls and monitors UAV systems), 2. Payload Team (adjusts camera settings) and 3. Mission Planning and Communications Team (oversees mission).
Size of Team	There were three levels in team size: **Small**= ideally 2-3 members, or less than 5 members. **Medium**= around 10 members, or 6-19 members. **Large**= 20 or more members.

The platforms were considered against the criteria provided by the SA. Platforms scoring zero to two points were categorized as 'Somewhat Relevant' (no platforms were irrelevant at this point in the review). Platforms scoring three to four points or five to six points were then considered for their primary purpose.

If the platform scored three to four points on the criteria provided by the SA and the primary purpose was Team Research, then the platform was deemed 'Relevant'. If the primary purpose of the platform was something other than Team Research, the platform was considered against the additional criteria distilled from this survey. Platforms scored one point each if the team size was small (i.e. no points for medium and large teams), and/or if it was a medium fidelity platform

(i.e. no points for low or high fidelity platforms). Platforms scored two points each for a virtual/constructive platform type (i.e. no points for live), and/or for an operational/strategic activity level (i.e. no points for tactical). Platforms scoring zero to three points on this third set of criteria were categorized as 'Somewhat Relevant', and platforms scoring four to six points were categorized as 'Relevant'.

If the platform received five to six points from the SA criteria and the primary purpose of the platform was Team Research, the platform was deemed 'Highly Relevant'. If the primary purpose of the platform was something other than Team Research, the platform was subject to the additional criteria distilled from this survey. Platforms receiving three or less points from the additional criteria were deemed 'Relevant' and platforms receiving four or more points were deemed 'Highly Relevant'.

Two platforms were rated 'Highly Relevant' although they did not meet all the requirements of the categorisation scheme. The metrics of the C3STARS facility (AWACS) platform spanned the different levels of analysis from individual capability and individual performance to more team-level processes and outcomes such as team communication effectiveness and Distributed Mission Training (DMT) effectiveness. The NASA Ames Centre - Distributed Research Facilities platform could manipulate both task and team stressors. Task performance, physiological measures, voice and email communication, personality, team dynamics and facial affect measures could be analyzed to identify the relations between stress, team interactions and task performance. Therefore, these two platforms were rated 'Highly Relevant' though they did not meet all of the requirements of the Rating Criteria.

All constructive platform types (completely simulated environments) were rated as Somewhat Relevant, even if they satisfied all criteria. The reasoning behind this rating is that all constructive platforms will be evaluated in the fourth work stream: evaluation of tools.

In addition to the review of platforms, eight organizations and/or facilities whose primary focus is simulation were researched for their modelling and simulation abilities. A general description of their research and initiatives are provided for reference on the Platform Table Search (Annex B). These particular organizations and/or facilities were reported because of their frequency of occurrence during the team research literature database searches. Their contributions to team research were noted to be significant and should be monitored for future development.

From the results obtained from the Sartori et al (2006) report, a mapping was developed to demonstrate the platform's correlation to the findings of the team literature review. This was done in an effort to synthesize the results to identify areas that are relatively unexplored in both the literature and platform reviews. The results from Sartori et al (2006) are presented in Annex C in the form of a mind map. This mind map makes it simple to track what factors represent subsets of other factors. For complete definitions of the factors used in this report, the reader is referred to Sartori et al (2006).

Factors to consider when planning team experiments were identified based on the literature review on teams. The interested reader is referred to Sartori et al (2006) for more detailed discussion, but for ease of reference, the criteria are listed below.

Table 4: Factors for Team Experiments

1 Team Factors
1.1 Individual Characteristics
1.1.1 Personality
-Agreeableness
-Conscientiousness
-Emotional stability
1.1.2 Cognitive ability
-Spatial orientation
-Verbal comprehension
-Reasoning ability
1.2 Team Diversity
-Heterogeneous
-Homogenous
1.3 Leadership
-Transactional
-Transformational
2 Task Factors
2.1 Task Complexity
-Scope
-Structurability
-Uncertainty
2.2 Workload
-Physical
-Cognitive
-Time pressure
2.3 Task Interdependence
-Additive
-Conjunctive
-Disjunctive
-Discretionary
3 Team Processes
3.1 Shared Knowledge
-Mental Models
3.2 Communication
-Communication Frequency
-Implicit vs. Explicit
3.3 Coordination
-Implicit vs. Explicit
-Interdependence
3.4 Adaptability
-Monitoring
-Backup Behaviours
3.5 Planning
Resource Allocation
3.6 Team Climate
-Morale
-Motivation
-Trust
-Cohesion
-Collective Efficacy
4 Measures
4.1 Outcome
-Computer
-Self-Report
-Observer
4.2 Level of Analysis
-Individual
-Team

It is unlikely that all of these factors will be applicable for all platforms. Rather, it represents criteria that should be considered in any effort to develop a platform for running team experiments. These factors were used as the basis of the platform data sheets in Annex A.

3. Results

The platforms were analyzed according to the six criteria suggested by the SA, their primary purpose, and if necessary, four additional criteria derived from the team platform survey. Platforms were rated as 'Highly Relevant', 'Relevant', or 'Somewhat Relevant' based on their compliance with the specified criteria.

In total, 44 platforms were reviewed. A platform data sheet format was developed to record and summarize the results for each platform (Annex A). The most relevant platforms are presented in the subsequent section.

3.1 Summary of Highly Relevant Platforms Reviewed

9 of the 44 platforms were rated as Highly Relevant. In order for a given platform to be considered Highly Relevant, the platform must be considered compliant with five or more of the six rating criteria provided by the SA, and have a primary purpose of team research. If the primary purpose did not correspond, the platform had to be considered compliant with five or more of the six rating criteria, as well as receive four or more points when judged by the additional criteria derived from the team platform survey. An exception was made for two platforms. These were deemed highly relevant based on their specific and detailed metrics and variables relevant to team experiments which they incorporated.

Each Highly Relevant platform is listed in this section. Information is presented below as an overview description of the platform indicating the primary purpose, description of platform type, simulation fidelity, team size, level of activity, operator or task description, illustrations (where available), and a summary of the mappings to the factors described in the Sartori et al (2006) report.

3.1.1 Agent Enabled Decision Group Environment (AEDGE)

AEDGE was developed based on cognitive and functional analysis of C3 mission, tactics, team member roles, and role interdependencies (Barnes, 2002). This platform is a distributed, real-time team decision support environment comprised of simulators, entity framework, intelligent agents and user interfaces. The primary purpose of AEDGE is to study decision making in teams.

AEDGE is both a constructive and virtual platform. As a constructive simulation, the behaviour and decision making of all hostile and friendly entities is directed by agent-based technology. However, as a virtual platform, AEDGE allows users to "log in" as a particular entity. This allows for direct comparison of human to agent decision making in using the virtual form. The user may choose to view recommendations generated by the agent for that entity, but if the human operator chooses not to view recommendations, the agent recommendations are still logged by the computer (Barnes, 2002).

The simulator fidelity of AEDGE is high, using intelligent agent technology to enhance simulation realism, decision support, and experimental manipulations. Team sizes are scaleable;

however, they are usually medium in size. AEDGE met all of the six criteria, except for one: it is not an interagency platform.

AEDGE is primarily a strategic and operational simulation. The operator task is an Airborne Warning and Control System (AWACS) task. The simulation entails the weapons director roles within AWACS. It was essentially developed to represent core characteristics of the AWACS and Weapon Director (WD) team. Resource allocation, search and optimization algorithms are basic components of AEDGE (Barnes, 2002). AWACS-AEDGE extends resource-allocation and optimization with AWACS/WD-objective functions and constraints, and then uses heuristic function evaluation. Figure 2 shows the AEDGE AWACS interface executing a decision making algorithm.

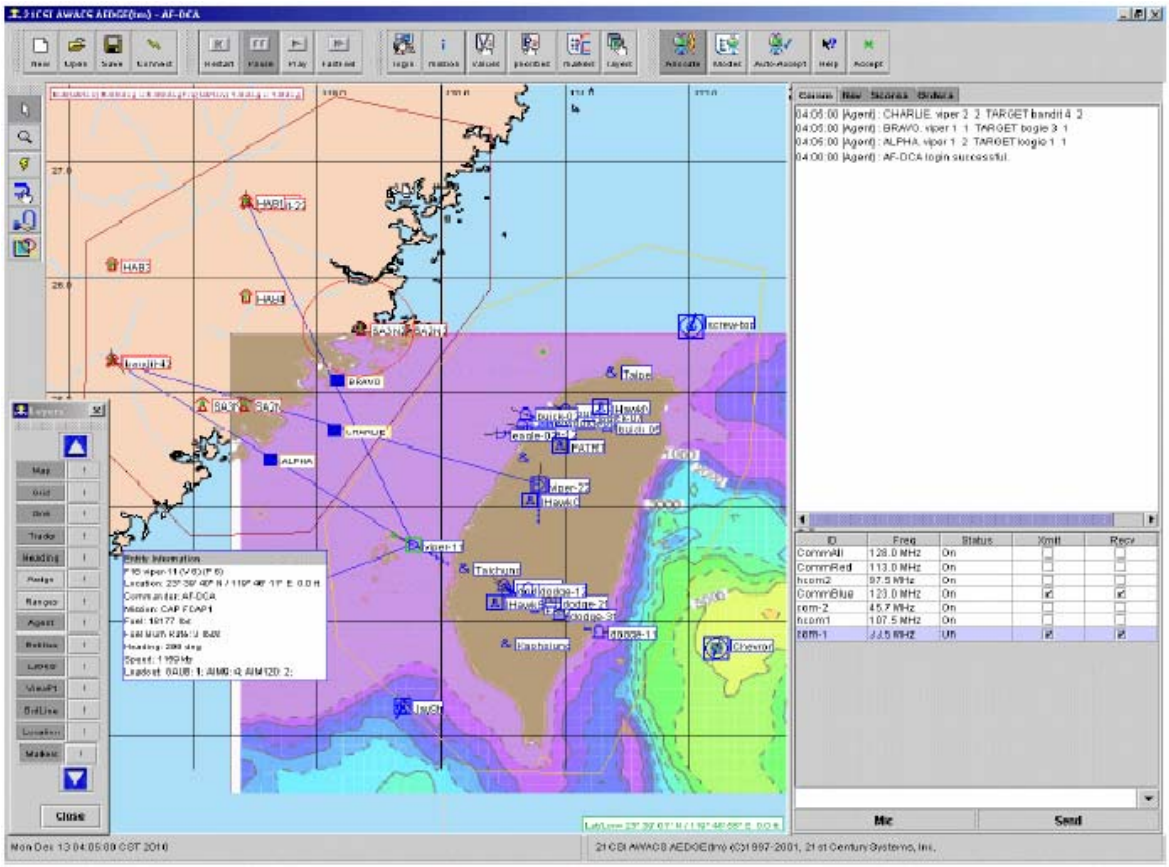

Figure 2: AEDGE AWACS Interface (Barnes, 2002)

The Team Factors addressed by AEDGE include:

- Transactional leadership
- Spatial orientation
- Verbal comprehension
- Reasoning ability
- Team diversity (heterogeneous)

The Task Factors addressed by AEDGE include:

- Task complexity - scope
- Cognitive workload
- Task interdependence (additive)

The Team Processes addressed by AEDGE include:

- Communication frequency
- Planning associated with resource allocation

The Measures addressed by AEDGE include:

- Computer-based outcome
- Observer-rated process
- Individual and team levels of analysis

3.1.2 Air Operation Centres (AOC)

Air Operations Centers (AOC) are the "nerve centres" where command and control takes place. AOCs are critical in the control, and execution of any aerospace mission. They are complex organizations that have a massive, continuous information flow at any given time. The primary purpose of the AOC simulation was to support and improve decision-making within the AOC. This will result in improved planning and assessment within the air tasking order (ATO) cycle, (Air Operations Centre, 2005).

AOC is both a constructive and virtual simulation. It is a medium fidelity simulation with large team sizes. AOC met all of the six criteria.

As a strategic and operational simulation, special attention is given to the interaction between the strategy planning team and the operational assessment team (teams-of-teams). The vertical interactions to be considered include the Joint Task Force (JTF) Commander, the Joint Forces Air Component Commander (JFACC), and the AOC Director. The horizontal interactions to be considered include the cells/organization/agencies with whom the Strategy Plans and Operational Assessment teams provide information to and get information from - both on the floor and in reachback/ reachforward locations, (Air Operations Centre, 2005). Figure 3 shows the current layout of an AOC.

Figure 3: AOC Layout (Air Operations Centre, 2005)

The Team Factors addressed by AOC include:

- Reasoning ability
- Team diversity (heterogeneous and homogenous)

The Task Factors addressed by AOC include:

- Unspecified

The team processes addressed by AOC include:

- Mental models

The Measures addressed by AOC include:

- Unspecified

3.1.3 AWACS in the Command, Control, and Communications Simulation, Training and Research System (C3STARS) Facility

C3STARS facility supports air, space, and information warfighter training. This facility provides the capability to represent a wide variety of weapon systems and training scenarios to include: Rivet Joint, JSTARS, AWACS, Uninhabited Air Vehicles, and Satellite Tracking and Surveillance systems, (Command, Control, and Communications Training, 2003). Areas of research include:

1) Distributed Mission Training

2) Team Performance Measurement

3) Training Effectiveness Research

4) Information Analysis

5) Intelligent Agent Models

6) Space-Based Surveillance Systems.

The primary purpose of the AWACS platform in the C3STARS facility was to investigate complex decision making among interdependent team members within a dynamic and realistic environment.

AWACS in the C3STARS facility is a virtual simulation. It is a high fidelity simulation, where realism is achieved through the functional representation of equipment and displays. AWACS in C3STARS met all of the criteria, except for two: it is neither an interagency nor a teams-of-teams platform.

As an operational simulation, AWACS in C3STARS uses only operational scenarios. The scenarios and crew stations simulate an air defence mission. For example, a mission could entail measuring the degree to which a team is successful at directing an interceptor aircraft to defeat an enemy aircraft, (Command, Control, and Communications Training, 2003).

The Team Factors addressed by AWACS in the C3STARS facility include:

- None

The Task Factors addressed by AWACS in the C3STARS facility include:

- Workload - physical and cognitive

The Team Processes addressed by AWACS in the C3STARS facility include:

- Mental models
- Communication frequency
- Planning associated with resource allocation

The Measures addressed by AWACS in the C3STARS facility include:

- Observer and computer-based outcome

3.1.4 Distributed Dynamic Decision Making (DDD)

DDD was developed to study how teams operate in complex and dynamic environments (Galster, Nelson, and Bolia, 2005). It is a "team-in-the-loop" multi-person virtual simulation platform. Designed to capture the essential elements of many different team tasks, DDD allows the experimenter to control and vary team structures, assign different access to information, and control resources. Its primary purpose is to conduct team experiments. It has been used to simulate military decision-making environments (e.g., Joint Task Force, AWACS), industrial environments (e.g. manufacturing systems, civilian search and rescue) and even health care applications (e.g. distributed diagnosis), (Aptima, 2005).

DDD is a low to medium fidelity simulation as DDD allows for a substantial degree of experimental control while maintaining a low to moderate degree of realism, (Galster, et al, 2005). The team size is usually small. DDD met all of the criteria, except for one: it does not support teams-of-teams.

Since the DDD platform is ideal for examining how high-performance teams operate in complex decision-making environments, it involves an operational and strategic level of activity. Figure 4 is an example of one type of interface used with DDD. In an empirical study, (Ellis, Porter, Hollenbeck, Ilgen, West, and Moon, 2003) team members in a four person team, were tasked to monitor activity in a geographic region and defend it against invasion from unfriendly air or ground tracks. Each team member was a decision maker. The team members' main objective was to identify any tracks that entered their assigned space (as the territory was split into 4 quadrants) and to determine whether they are friendly or unfriendly. In this version, participants were seated in close proximity at four networked computer terminals. Verbal communication was the only method of communication allowed during their task and they were free to communicate as frequently as they wanted.

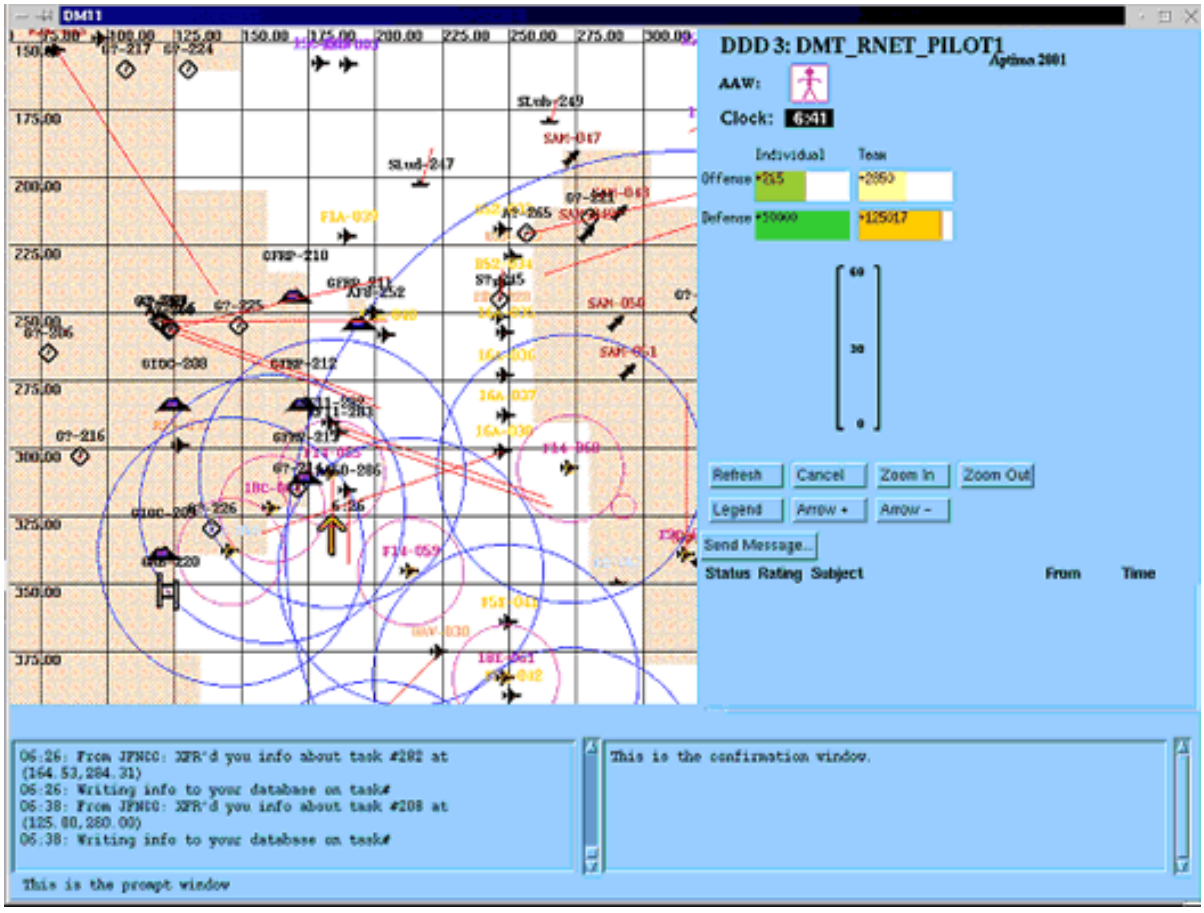

Figure 4: One type of user interface used with DDD (Aptima, 2005)

The Team Factors addressed by DDD include:

- Agreeableness
- Verbal comprehension

The Task Factors addressed by DDD include:

- Task complexity - uncertainty
- Workload - cognitive and time pressure
- Task interdependence

Team Processes addressed by DDD include:

- Communication frequency
- Adaptability - monitoring
- Planning associated with resource allocation

Measures addressed by DDD include:

- Computer-based outcome

3.1.5 NASA Ames Centre- Distributed Research Facilities

The NASA Ames' Centre researches a vast range of emerging technologies that support NASA missions and space exploration. The Distributed Research Facility has an ongoing project for distributed team decision making. Its primary purpose is to study team interaction and decision making performance using a computer-based simulated search and rescue mission set in Antarctica (or Mars). A number of variables can be manipulated, such as team and task stressors and team composition. Team composition variables include gender and national culture. Data is collected both through computer and questionnaires (self-reporting). Time synchronized data is recorded via computer (based on task performance), physiological measures, audio and video recordings. These support analyses of team processes and outcomes, including responses to task and interpersonal stress. Questionnaire data include workload, team dynamics and individual difference measures, e.g., personality and cognitive processes, (Dino, 2005).

The NASA Ames Centre - Distributed Research Facilities is a virtual simulation. It is high fidelity and uses only small team sizes. It met all of the six criteria, except for two: it does not support joint activities or teams-of-teams.

Since the scenario involved in this platform is a search and rescue mission, it can be categorized to have a primarily strategic level of activity; however it can involve operational and tactical components. In the scenario described in Dino (2005), teams are composed of four or five members that engage in an Antarctic or Mars search mission. Their mission spans a period of four days (one day of training, three days involving six simulations). The objective is for teams to work together to locate a lost party sent to repair a malfunctioning communication antenna. They are required to develop plans and strategies, share information, manage resources, and cope with unexpected problems under time pressure. Figure 5 shows members in a distributed team interacting in a simulated study.

Figure 5: Four-member teams interact in a simulated study (Dino, 2005)

The Team Factors addressed by the NASA Ames Centre- Distributed Research Facilities include:

- Individual personality traits - agreeableness, conscientiousness, and emotional stability
- Verbal comprehension
- Team diversity (heterogeneous and homogeneous)

The Task Factors addressed by the NASA Ames Centre- Distributed Research Facilities include:

- Workload - physical, cognitive, and time pressure
- Task interdependence

The team processes addressed by the NASA Ames Centre- Distributed Research Facilities include:

- Communication frequency
- Team adaptability - monitoring
- Team climate - trust, cohesion

The Measures addressed by the NASA Ames Centre- Distributed Research Facilities include:

- Computer-based and self-report outcome

3.1.6 NeoCITIES

NeoCITIES is an interactive computer program involving a major team resource allocation problem in a virtual city space. The simulation was designed to emulate the resource management of a city's emergency services (EMS) in a crisis management situation, whereby interaction must occur between three distinct teams (e.g. Police Department, Fire, and EMS, or Hazardous Materials), (McNeese, Bains, Brewer, Brown, Connors, Jefferson, Jones, and Terrell, 2005). It is a scaled-world simulation that was developed for the purpose of performing empirical and applied research on teamwork, team cognition, distributed team communication processes, and virtual team decision-making (Jones, McNeese, Connors, Jefferson, and Hall,

2004, as cited in McNeese, et. al, 2005). It is based in a command, control, and communication (C3) environment. Its secondary purpose is to examine the affects of hidden knowledge versus shared knowledge on team performance.

As a virtual simulation, users are emerged in serious decision-making scenarios. Based on the available literature, NeoCITIES appears to be a medium fidelity simulation. Teams are fixed in size (small), having only 2 members per team. However, NeoCITIES requires the use of teams-of-teams, usually three sets of 2 member teams. NeoCITIES met all six of the criteria, except for one: it does not support joint activities, since this is not a direct military application.

NeoCITIES is an operational level simulation. In addition to the crisis management situation and the scenarios developing within, counterterrorism events can sporadically occur. Indeed, the participant reaction required by the simulation may actually place the simulation almost at the tactical level.

For initial empirical testing (McNeese et. al, 2005), participants were assigned to one of three teams with each team being composed of two team members. Within each of the three teams, there are two team positions: the information manager (IM) and the resource manager (RM). The primary responsibilities for the IM are to process incoming information about event in the city that may need to be addressed. S/he must then convey the information to the RM of those events that require action by that team, and communicating information across all of the teams. The RM is responsible for allocating resources, monitoring their progress, reallocating them as required, and communicating event status and information generated "on-site" back to the IM. All teams have common goals: to respond to emerging events, maintain order within their city, and prevent a city-wide catastrophe from being initiated by terrorists and insurgents. Figure 6 shows the NeoCITIES interface.

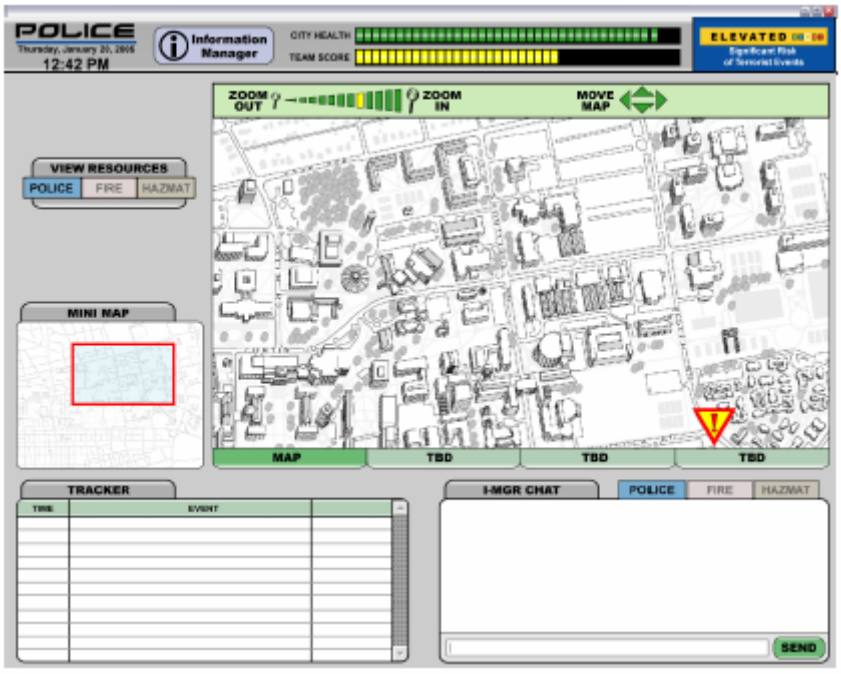

Figure 6: NeoCITIES Simulation Interface (McNeese, et, al 2005)

The Team Factors addressed by NeoCITIES include:

- Reasoning ability

The Task Factors addressed by NeoCITIES include:

- Workload - cognitive and time pressure

The Team Processes addressed by NeoCITIES include:

- Communication frequency
- Communication type (implicit and explicit)

The Measures addressed by NeoCITIES include:

- Computer-based outcome

3.1.7 One Semi-Automated Forces (OneSAF)

OneSAF is a PC-based or laptop training system (workstation) that uses a graphical interface to simulate military training scenarios. It is an entity based simulation designed to train leaders at the brigade level and below. It will ultimately be deployed to all active duty brigades and battalions in the US (Miller, 2002); Army schools, labs and engineering centers; National Guard and Army Reserve units and other destinations as approved (Miller, 2002). Its primary purpose is for training. It is expected to be fully deployed in 2007 or 2008 as a single simulation for all of the US Army's modelling and simulation domains (Miller, 2002).

OneSAF is both a constructive and virtual simulation. OneSAF can represent a full range of operations, systems, and control processes with a variable level of fidelity, (OneSAF, 2004). Team sizes can also vary, from individuals or small teams, to battalion level (large teams). OneSAF met all six criteria except for one: it is not an interagency platform.

OneSAF is primarily a tactical simulation used for training. However, it was designed to train leaders, thus it can be seen as operational as well as tactical in its level of activity.

The system simulates activities of ground warfare, such as weapon systems, tanks and battle positions. OneSAF can accurately represent aircraft, such as helicopters, and includes modelling a radar system. It also focuses on engagement and manoeuvre. OneSAF will include Command, Control, Communications, Computers and Intelligence (C4I), as well as combat support. OneSAF will also employ highly realistic representations of the physical environment where soldier movements and behaviours can be reproduced to enhance training value by using a detailed terrain database, (Miller, 2002). Figure 7 shows an example of a digitalized military map in the OneSAF interface.

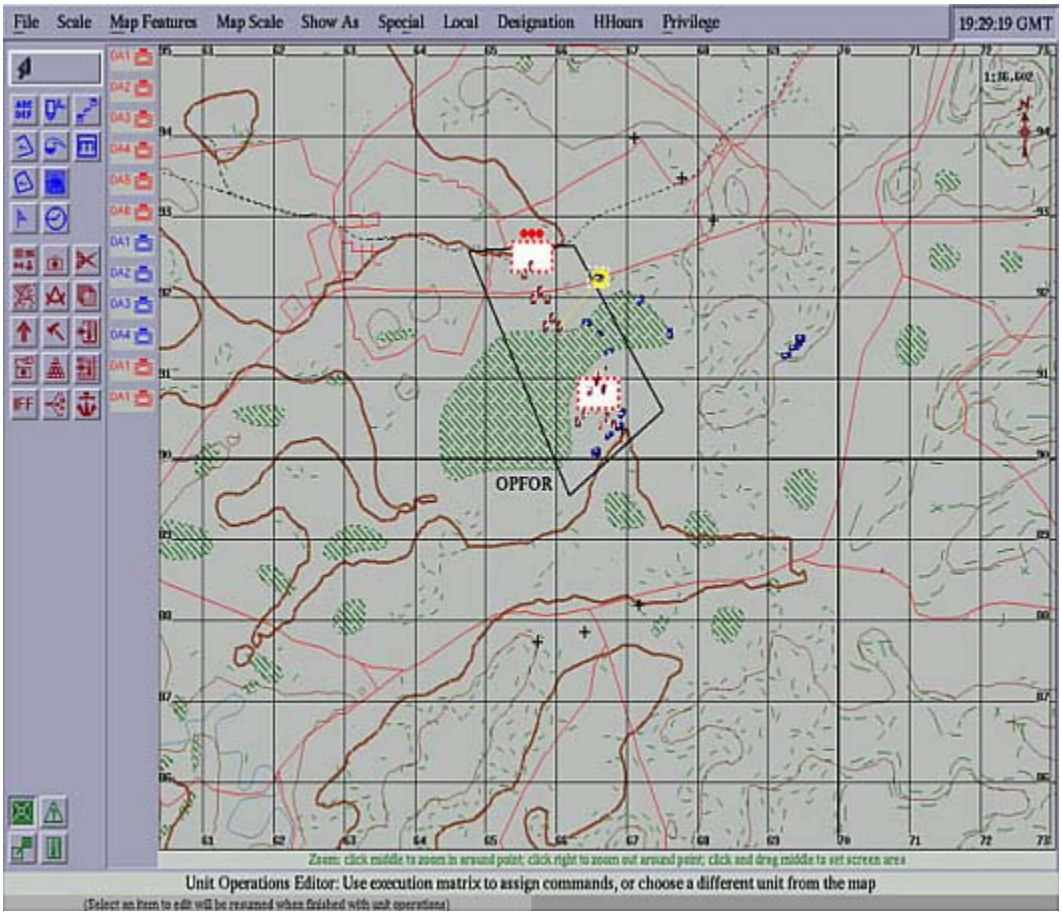

Figure 7: OneSAF interface (The U.S. Army's New Tactical Wargame, 2005)

The Team Factors addressed by OneSAF include:

- Transactional Leadership
- Spatial orientation
- Verbal comprehension
- Reasoning ability

The Task Factors addressed by OneSAF include:

- Task complexity – scope, structurability
- Workload - cognitive and time pressure
- Task interdependence

The team processes addressed by OneSAF include:

- Mental models
- Communication frequency

The Measures addressed by OneSAF include:

- Computer-based outcome

3.1.8 Tactical Simulation System (TACSIM)

The Tactical Simulation System (TACSIM) is the Army's leading intelligence collection and dissemination model using interactive computer-based simulation (Tactical Simulation System, 2005). It is used for the training of Intelligence Analysts, Collection Managers, and staffs for the design of collection requirements and the analysis of raw intelligence. Its primary purpose is to provide training to intelligence staff in tactical situation (i.e. war).

TACSIM is a virtual simulation. From the platform literature review, the fidelity of TACSIM could not be determined. It is speculated to be of medium to high fidelity. The team size is scaleable, as TACSIM can support training from large scale joint exercises, or used for intelligence training only, TACSIM allows intelligence teams, sections, and units to train their personnel on specific objectives (Pike, 2005). TACSIM met all but one of the criteria - it is not an interagency platform.

The level of activity of TACSIM is strategic, operational, and tactical. This platform is extremely flexible. TACSIM is often used in its “linked mode”. TACSIM can be linked to other services’ models; the Air Force's Air Warfare Simulation (AWSIM), the Navy's Research Evaluation and Systems Analysis (RESA), the Marine's Air-Ground Task Force Tactical Simulation (MTWS) and the Joint Electronic Combat Electronic Warfare Simulation (JECEWSI). These platforms were not examined in this literature review, since they do not involve team research simulations. Linking is accomplished through the Aggregate Level Simulation Protocol (ALSP) system (Pike, 2005).

The Team Factors addressed by TACSIM include:

- Spatial orientation
- Reasoning ability

The Task Factors addressed by TACSIM include:

- Cognitive workload

The team processes addressed by TACSIM include:

- Communication frequency

The Measures addressed by TACSIM include:

- Computer-based outcome

3.1.9 Virtual Warfare Centre (VWC)

The Virtual Warfare Centre (VWC) is a state-of-the art centre that allows military experts to analyze and take part in simulated battle scenarios. This is part of the effort to develop future systems and platforms. The 70,000 square foot facility enables more than 150 operators from all military services to participate in warfare-scenarios in real time at the VWC and through military labs across the country (Lewis and Walsh, 2005). The VWC contains battle scenarios with

thousands of air and ground targets, multiple hostile threats and diverse communication networks introduced. The VWC has been stated to be one of the most complex testing environments outside actual warfare (Lewis and Walsh, 2005). The VWC was designed for the evaluation of emerging operational concepts for the primary purpose of VWC training.

As a virtual simulation, experiments are conducted to evaluate the impact on systems-of-systems and individual systems. The VWC is a high fidelity simulator, portraying realistic battle scenarios. Team sizes are generally scaleable, however, they are assumed to be generally large because of the nature of collaboration in the VWC.

VWC is an operational simulation. The VWC has a designated war room which is dedicated to monitoring test execution, control of simulations, and visual data displays that enable system analysts and decision-makers to witness and understand emerging events (Modelling Simulation and Analysis, 2005). This simulation environment allows warfighters to observe and control jet aircraft (F-15, F-18, etc.), AWACS, and Patriot platforms. The VWC has reconfigurable crew stations which enable the incorporation of data into the test environment from F-15 C/E, F/A-18 E/F, and F/A-22 aircraft, flown by warfighters.

The Team Factors addressed by VWC include:

- Transactional leadership

The Task Factors addressed by VWC include:

- Task complexity - uncertainty
- Task interdependence

The Measures addressed by VWC include:

- Computer-based outcome
- Observer-rated outcome

The Team Processes addressed by the VWC include:

- None

3.2 Six Criteria Results

All platforms were rated on the six criteria: ad hoc, interdisciplinary, interagency, joint, distributed, and teams-of-teams. Many of the platforms satisfied a combination of the criteria, (e.g. ad hoc, interdisciplinary and joint or distributed and teams-of-teams). Table 5 shows the number of platforms, out of the 44 platforms reviewed, that satisfied the given criteria. A platform was considered to satisfy a criterion if the analysts gave “Yes” or “Capable” responses during their review of the available information.

Table 5: Platforms Satisfying Criteria

Criteria	Number of Platforms that Satisfied Criteria
Ad Hoc	32
Interdisciplinary	37
Interagency	15
Joint	26
Distributed	35
Teams-of-teams	24

As seen from the results in Table 5, the criterion that was least addressed was interagency (34%). The criterion that was most commonly satisfied was interdisciplinary (84%). The next criterion most commonly satisfied was distributed (80%). Characteristics of the platforms that satisfied each criterion will be discussed in Section 4.

3.3 Team Size Results

It was important to identify the team size for each platform that was reviewed. The team size was cited in the available literature for all platforms except for two. Table 6 shows the number of platforms for each level of team size.

Table 6: Platforms for Different Team Sizes

Team Size	Number of Platforms
Small	21
Medium	8
Large	3
Scaleable	10
Unspecified	2

About 48% of the platforms reviewed addressed small teams. About 23% of all the platforms had scaleable team sizes. These results will be analyzed in Section 4.

3.4 Level of Activity Results

The level of activity was identified for each platform as either: Strategic, Operational, Tactical, Strategic/Operational, Operational/Tactical, Strategic/Tactical, or Strategic/Operational/Tactical. Table 7 shows the number of platforms at each level of activity. These results can be considered as the primary level of activity as identified on the data sheets in Annex A. There were two

platforms that the level of activity did not apply because they were out of the military domain, as they were both medical simulation platforms.

Table 7: Platforms' Level of Activities

Level of Activity	Number of Platforms
Strategic	2
Operational	9
Tactical	17
Strategic/Operational	3
Operational/Tactical	10
Strategic/Operational/Tactical	1
Not Applicable	2

About 39% of the platforms reviewed were Tactical. About 23% of all the platforms were Operational/Tactical. Only 5% of the platforms were primarily Strategic, only 7% were primarily Strategic/Operational, and 20% were primarily Operational.

3.5 Factors Affecting Performance

All platforms were assessed to examine the factors affecting team performance as listed on the data sheets in Annex A. It should be noted that these results were obtained from subjective assessments based on the literature reviewed for each platform. Table 8 shows the number of platforms satisfying a given factor.

Table 8: Factors Affecting Performance

1 Team Factors	Number of Platforms
1.1 Individual Characteristics	
1.1.1 Personality	
Agreeableness	2
Conscientiousness	2
Emotional stability	2
1.1.2 Cognitive ability	
Spatial orientation	6
Verbal comprehension	6
Reasoning ability	5
1.2 Team Diversity	
Heterogeneous	12
Homogenous	6
1.3 Leadership	
Transformational	1
Transactional	9

2 Task Factors	Number of Platforms
2.1 Task Complexity	
Scope	4
Structurability	3
Uncertainty	4
2.2 Workload	
Physical	13
Cognitive	20
Time pressure	9
2.3 Task Interdependence	11
Additive	9
Conjunctive	1
Disjunctive	0
Discretionary	2
3 Team Processes	**Number of Platforms**
3.1 Shared Knowledge	
Mental Models	12
3.2 Communication	
Communication Frequency	13
3.3 Adaptability	
Monitoring	5
Backing-Up	2
3.4 Planning	
Allocation of Resources	9
3.5 Team Climate	
Morale	1
Motivation	0
Trust	1
Cohesion	2
Collective Efficacy	2
4 Measures	**Number of Platforms**
4.1 Outcome	
Computer	21
Self-Report	2
Observer	9
4.2 Level of Analysis	
Individual Performance	6
Team Performance	10

In terms of Team Factors, about 27% of the platforms reviewed addressed heterogeneous teams (team diversity factor). About 20% of the platforms reviewed addressed Transactional Leadership.

In terms of Task Factors, common task factors included types of workload: physical (30%), cognitive (45%), time pressure (20%), and task interdependence (25%). It was observed that task complexity was not commonly addressed: scope (7%), structurability (9%), and uncertainty (9%).

The Team Process addressed by a large number of platforms was mental models (27%).

About 48% of all platforms used computer based measures and 20% used observer based measures. 11% used both computer and observer based measures, 5% used self-reporting, and 1 platform used computer and self-report methods. These statistics are limited to the measures explicitly described in the 44 platforms reviewed for this report, hence the percentages do not sum to 100%. Some papers did not discuss their measurement approach.

3.6 Other Notable Observations

It is important to identify any noteworthy capabilities of team research platforms that may support the development of insights into the military's ability to interact with organizations outside of the CF. Accordingly, each platform in this review was screened for its unique capabilities. Not all of these platforms were considered 'highly relevant', so they may not have been described in detail in Section 3.1

The platform AEDGE has an interesting capability with respect to the use of agents (computer generated participants) to "play" any role in a given scenario, allowing the study of individual (as well as team) performance in a complex but controlled team setting. Another interesting capability of AEDGE is voice recognition and response. Human voice commands can direct simulation tasks, and agent based communications can also be heard (Barnes, 2002).

Generally, the tactical simulations had similar characteristics and capabilities. OneSAF was a noteworthy tactical simulation platform because of its unique key feature of the Mission Planning and Rehearsal System (MPARS). This system allows commanders to plan actions that will occur in an area of deployment using a terrain database of the area. Tactical rehearsals can be run effectively, simulating specific activities of ground warfare, specifically engagement and manoeuvre. Using the detailed terrain database, OneSAF has highly realistic representations of the physical environment where soldier movements and behaviours can be reproduced, thereby enhancing training value (Miller, 2002).

A platform that had a unique interface configuration was ADMS (see A-10), which satisfied the interdisciplinary, interagency, and distributed criteria. A typical ADMS system includes one Incident Command Station and up to four Team Stations (Figure 8). However, ADMS can be installed with a 180-degree surround view projection screen or a simple flat screen for the Incident Command Station. Figure 9 shows a sample of an ADMS interface with one Incident Command Station and four interagency Team Stations. Team stations can be setup within canopied hoods, obstructing sharing of extraneous information between stations and forcing realistic radio communication (Advanced Disaster Management Simulator, 2005). ADMS is also unique in that it provides an advanced virtual reality in its 3D, real-time, training environment.

Figure 8: ADMS Flat screen set-up (Advanced Disaster Management Simulator, 2005)

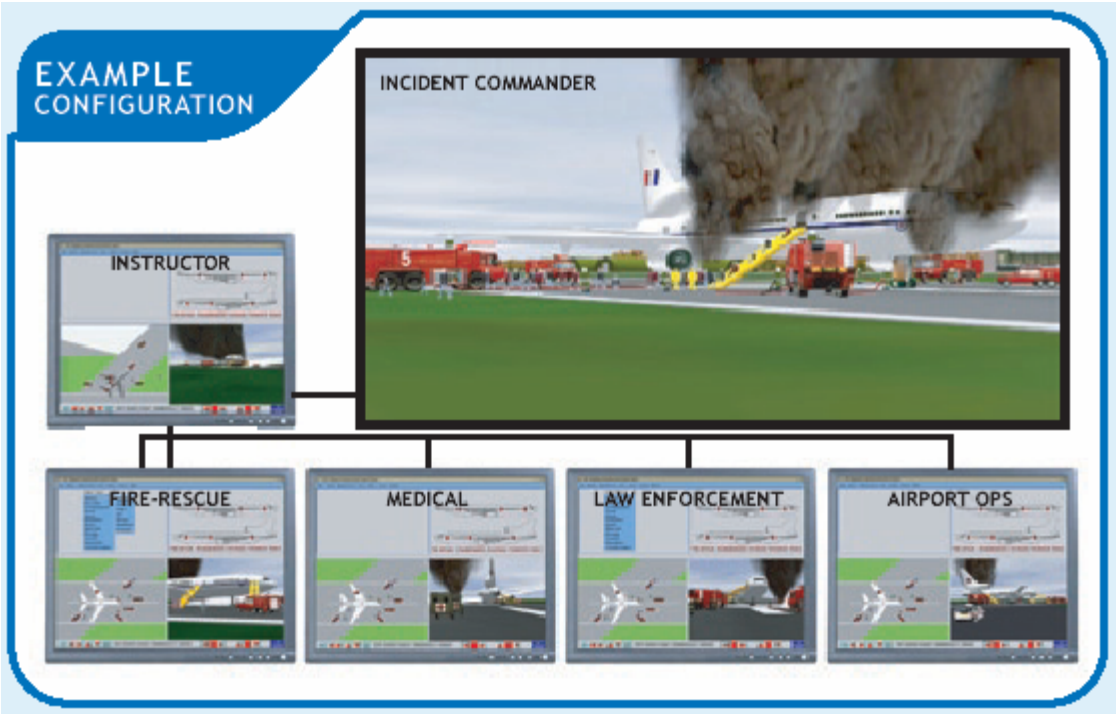

Figure 9: A typical ADMS system includes one Incident Command Station and four (interagency) Team Stations (Advanced Disaster Management Simulator, 2005)

Dangerous Waters (which satisfied all but the interagency criteria) is a video game platform that had some notable capabilities (see A-27). Players can select from air, surface, or submarine platforms, in which they will compete in campaigns to accomplish their missions. Upon selecting their platform and mission difficulty level, the player will be provided with a random scenario (the same campaign will never be played more than once). Dangerous Waters is unique in that it was the first video game of its kind that gives the player total control over multiple air, surface and submarine platforms (Dangerous Waters, 2005). The game is primarily a tactical

simulation, with less emphasis on strategic and operational aspects, in spite of the campaign planning element. Nonetheless, it could be used in an operational manner if so desired.

The Rhode Island Hospital Medical Simulation Centre (see A-35) had an interesting virtual simulation set-up (which satisfied 3 out of the 6 criteria.)The centre is a 3,000-square-foot replica of an emergency department, which contains bays that transform into an operating room, critical-care setting or ambulance interiors. The use of one-way mirrors to observe medical trainees provides a good method of observation, that can be considered for use in a new team research platform. The centre uses six SimMan™ high fidelity manikins with fully computerized control and audiovisual interactive capability. Figure 10 shows trainees with SimMan™. Located behind a wall of one-way mirrors are observers and an audio-visual room that houses the manikin controls (see Figure 11). After an exercise, a team and its mentors study a videotape of the simulated emergency. This evaluation focuses on roles and responsibilities, problem solving, communications, workload distribution and human factors (Rhode Island Hospital Medical Simulation Centre, 2005).

Figure 10: Rhode Island Hospital Medical Simulation Centre with manikin patient (Rhode Island Hospital Medical Simulation Centre, 2005)

Figure 11: Rhode Island Hospital Medical Simulation Centre, observer behind the one-way mirror (Rhode Island Hospital Medical Simulation Centre, 2005)

The DDD Platform satisfied all but one of the six criteria. It is ideal for understanding how high-performance teams operate in complex decision-making environments. DDD is unique in the number of variables that can be controlled and the ease with which they can be varied. Specifically, task loads in DDD scenarios can easily be manipulated by changing the number, type, timing and uncertainty associated with the tasks that need to processed. In addition, organizational structures can be manipulated by changing authority levels, ownership of assets, communication variables, information availability variables (shared knowledge), and team membership variables, (Galster et. al, 2005).

The platform FIRSTplus Radar Air Traffic Controller Simulator (see A-29) (which satisfied five out of the six criteria,) was observed to have unique capabilities in terms of creating scenarios and the simulation environment. This platform provides a complete user-definable environment such as airports, maps, air/ground fixes, air routes, electronic and paper flight strips, sectorization plans, aircraft performance data and weather data (FIRSTplus Radar ATC Simulator, 2002). These capabilities are unique to the simulations in the Air Traffic Control domain.

4. Discussion

This section will review the typical characteristics of all the platforms studied. Capabilities that are common to multiple platforms will be discussed in addition to unique capabilities of specific platforms. Strengths and weaknesses of platforms that satisfy each criterion will also be identified.

4.1. Ad Hoc Platform Characteristics

A total of 32 platforms were capable of Ad hoc teams. It is intuitive to consider the Ad hoc criterion in conjunction with the given task in each platform, since team structure is inherent to the task. Some of the tasks and/or operator descriptions in the platforms reviewed were left open or flexible. In these cases, the platform was assumed to be able to handle Ad Hoc teams.

A platform that is able to support ad hoc teams tends to be one with great flexibility. This flexibility can range from variable team sizes to types of scenarios that can be created within the platform. All of the medical domain platforms were capable of ad hoc teams, as they simulate emergency situations (e.g., emergency room (ER) surgery) where the team is composed of any available doctors or nurses. At the Rhode Island Hospital, the simulation facility aimed to minimize the possibility of medical error by training medical professionals. Medical teams trained by working together during simulated emergencies. Afterwards, the teams and their mentors studied videotapes of the simulated emergencies (Turner, 2002). Some of the factors that are evaluated in this simulation include: team roles and responsibilities, problem solving, communication, and workload distribution.

Another type of platform that frequently involves ad hoc teams are video games. Video games are capable of being networked and played by users who may not have any prior knowledge of each other. For example, the video game "Dangerous Waters" can be played in multi-player and multi-station mode over a network. An example of a video game used for experimental purposes is Comanche 2.0, a Navy helicopter flight simulator. In the study by Cooke, Salas, Kiekel, Stout, Bowers and Cannon-Bowers (2003), Comanche 2.0 was used to study taskwork and teamwork knowledge for team members with different backgrounds. Three individuals were introduced to each other (as part of one team) to participate in a simulated helicopter rescue-and-relief mission.

Flexibility is often a major advantage of a platform that is capable of supporting ad hoc teams, allowing for different customized scenarios and variable team compositions. However, the manner in which the platform is flexible must be fully understood in order that the experimental team can exercise sufficient control over the sources of variability to allow them to generalise from the results.

4.2. Interdisciplinary Platform Characteristics

The majority of platforms, 37 out of 44, were capable of interdisciplinary teams. The interdisciplinary criterion did not map to any factor in the mindmap produced in the Team Modelling Literature Review (Sartori et al, 2006). Many of the interdisciplinary platforms

identified a distinct role for each team member where individual training and education must differ. A prime example is the CERTT Laboratory (Cooke, 2005) (see A-13). CERTT was created to understand and measure team cognition in socio-technical systems. This is achieved through their study of Uninhabited Air Vehicle (UAV) simulation. This simulation uses a three-person UAV ground control task. Each team member has a well defined role:

(1) AVO (Air Vehicle Operator) - controls airspeed, altitude, and heading; monitors UAV systems

(2) PLO (Payload Operator) - adjusts camera settings to take target photos; monitors camera equipment

(3) DEMPC (Data Exploitation, Mission Planning and Communications Operator) - oversees the mission; plans a route under various constraints; reports locations and restrictions.

Each of these roles requires different training backgrounds. Some of the variables that have been measured in these studies include: situation awareness, teamwork knowledge, taskwork knowledge, team process, leadership, and demographics.

A correlation was observed between the interdisciplinary criterion and team size. Generally, smaller team sizes consist of more interdisciplinary team members than larger teams. Larger teams usually have an overlap in roles (i.e. more than one person performing the same task). An example of this can be seen in Raytheon's FIRSTplus Radar Air Traffic Control simulator (Raytheon, 2002) (see Annex A-29). Its primary purpose is for air traffic controllers. Although no specific scenario was outlined in the FIRSTplus Radar literature, a radar monitoring task can be executed by more than one person on the same team.

The main strength of a platform capable of interdisciplinary teams is that it will more readily support experiments on team composition and task type. Individual team roles that are clearly defined also make it easier to define measures of performance and/or effectiveness. This provides an advantage in data capture. There were no evident disadvantages or weaknesses for platforms capable of interdisciplinary teams.

4.3. Interagency Platform Characteristics

The interagency criterion was the least commonly satisfied out of all the criteria examined. Only 15 platforms had interagency capability. The Team Modelling Literature Review mind map (Sartori et al, 2006) did not explicitly map interagency as a factor in team performance. However, the interagency criterion can be considered as a characteristic of the task and as such, a Task Factor, (e.g. one must work with different agencies), and also as part of Team Composition (e.g. the team that will achieve the mission objective spans different agencies).

Most of the platforms that satisfied the interagency criterion had well-defined types of scenarios. The majority of these platforms were for emergency response or crisis management. NeoCITIES (see A-6) is a perfect example of a platform that demonstrates interagency capability. The teams in NeoCITIES represent three separate services, Police, Fire/EMS, and Hazmat, where they must assess situations, interact and communicate according to their inter-team and intra-team roles, allocate resources, and make decisions within the context of emergency crisis management (McNeese et. al, 2005).

Another prime example of an interagency platform is the Advanced Disaster Management Simulator (see A-10). ADMS is an interactive virtual reality-based team training system that provides emergency responders, including incident commanders and team leaders, with an opportunity to develop their disaster management skills (Advanced Disaster Management Simulator, 2005). Some examples of emergency incidents include: aircraft accidents, terrorist acts, weapons of mass destruction, hazardous material spills, airfield incursions, multi-vehicle road accidents, and fires and natural disasters.

The interagency criterion was commonly found in conjunction with the distributed criterion. Interagency teams were generally distributed versus co-located. This is because each agency would work and coordinate from within each of their facilities.

The strengths of platforms that have interagency capability include: support of interdisciplinary teams, support of ad hoc teams, and superior or enhanced communication media. Because interagency teams are usually distributed, an effective communication medium and/or supporting technology must be in place. Some weaknesses of interagency teams (not to be confused with weakness in the platform) may become evident in team processes, where there could be a lack of shared knowledge, communication, coordination, and planning.

4.4. Joint Platform Characteristics

The joint criterion did not map onto the Team Modelling Literature Review mind map (Sartori et al, 2006) because it tends to refer specifically to military teams. Out of the 34 military platforms reviewed, 26 had joint capability. The scenarios in these platforms would focus on joint missions between land, sea, and air. An example of a joint platform is the U.S. Air Force's C3STARS facility (see A-3). This facility is used to investigate complex decision making among interdependent team members in air defence missions of Airborne Warning and Control System (AWACS). The C3STARS facility is enhanced by connecting the crew stations to the Advanced Distributed Simulation (ADS) network-enabling assets at other Department of Defense (DOD) facilities to be integrated into multi-force simulation exercises (C3STARS, 2003). The system can transmit audio communication and simulation events between all local and distributed networked facilities, allowing many-to-many (conference) and point-to-point conversations over standard direct and dial-up voice lines, digital networks and remote communication systems. Metrics include individual and team-level processes and outcomes such as individual effectiveness, team communication effectiveness and Distributed Mission Training (DMT) effectiveness.

All platforms capable of joint teams should have a networking capability, since most joint teams are distributed (versus co-located). Without such a capability a joint team will need to be co-located, which may adversely affect the generalisability of the results. This is a hardware and software requirement. Another example of a platform that uses joint teams is Corps Battle Simulation (CBS) (see A-15). CBS is a geographically and functionally distributed air/land warfare simulation that drives the U.S. Army Battle Command Training Program's (BCTP) War Fighter Exercises as well as Corps and Division command post training exercises for the active Army, National Guard, and the US Army Reserve (Zedo, 2005). The CBS simulation also serves as the Land Warfare component of various Joint Training Exercises as a member of the Joint Training Confederation (JTC). A typical CBS hardware configuration includes one PC Game Events Executive Processor (PC-GEEP) to run the simulation software, multiple MicroVAXs and

associated suites of workstation hardware. MicroVAXs are used to execute the workstation software and control the workstation hardware suites. Each MicroVAX can control up to six workstations. One MicroVAX is required to run the communication software (in a multi-site exercise, at least one MicroVAX is required at each site for communications) (Corps Battle Simulation, 2005).

The main strength of a platform capable of joint teams is the investigation of team processes associated with teams that may not be working toward the same goals; such as shared knowledge, communication, coordination, and planning. Indeed, these processes may show differences between team members because of their backgrounds. Similar to platforms that are capable of interagency teams, joint platforms tend to have enhanced communication and network capabilities. Another strength of joint platforms is that their scenarios tend to have greater flexibility. Since scenarios for platforms with joint teams usually involve a shared mission between combinations of air, land, and maritime forces, there is more flexibility in scenario development. One final point about a platform capable of joint teams is that data collection may be more difficult due to the greater number of different parties involved. Of course, this assumes that the joint team is faithfully represented, rather than abstracted.

4.5. Distributed Platform Characteristics

The majority of platforms, 35 out of 44, were capable of distributed teams. This criterion of physical distribution of teams has been of increasing importance in terms of team performance and effectiveness. In the Team Modelling Literature Review mind map (Sartori et al, 2006), the distributed criterion can be directly mapped under Team Factors → Physical Distribution. Physical Distribution can be distributed or co-located.

The platforms that were capable of distributed teams crossed all domains, from military applications to video games. The most important attribute of a distributed platform would be its network capability. As briefly discussed in the sections on interagency and joint platforms, networking entails hardware and software requirements.

Some of the platforms reviewed incorporated the use of High-Level Architecture (HLA). HLA is a general purpose architecture used for distributed computer systems. It allows computer simulations to communicate to other computer simulations with different computing platforms. An example of such platform is the Joint Theatre Level Simulation (JTLS) (see A-17). JTLS is a simulation tool used in joint training programs (for the US Joint Forces Command) with a focus on the operational level of war. This simulation supports links to most fielded real-world command and control, communications, computers and intelligence (C4I) systems and other C4I models through customized interfaces. By also including high-level architecture (HLA) applications this platform provides maximum utility and usability (see A-17).

Another way to allow simulations to communicate with other simulations is via Aggregate Level Simulation Protocol (ALSP) system. ALSP is a system of software and protocols used to interoperate a simulation, and is used extensively to support the United States military to link analytic and training simulations (Aggregate Level Simulation Protocol Web Site, 2002). ALSP consists of three components: (1) Infrastructure Software that provides distributed runtime simulation support and management, (2) Interface that consists of a set of generic data exchange message protocols (i.e., formal rules for information exchange) to enable interaction among

objects represented in different simulations, (3) Participating simulations adapted for use with ALSP. An example of a platform that uses ALSP reviewed in this study is TACSIM (see A-8), which is frequently used in its linked mode to link to other services' models.

Many distributed platforms simply used Wide Area Networks (WAN) to establish connectivity. For example, Air Defence Synthetic Environment's (ADSE) primary goal was to develop a validated set of networked simulation assets representing current and future ground based Air Defence (AD) systems. The owners of the AD real systems were responsible for their development, validation and support at their home sites across the UK. This inevitably resulted in the requirement to create a Wide Area Network (WAN) interconnecting many sites across the UK (Air Defence Synthetic Environment, 2005).

A strength of a distributed platform is that the distributed architecture enables scalability of scenarios and multiple concurrent users, such as interagency and joint users. A distributed platform allows the experimenter to vary team structure, access to information, and control of resources. A foreseeable weakness of a distributed platform would be a network connection failure. If the hardware/software technology fails, the distributed architecture will breakdown.

4.6. Teams-of-teams Platform Characteristics

Twenty-four of the 44 platforms reviewed satisfied the teams-of-teams criterion. In the Team Modelling Literature Review mind map (Sartori et al, 2006), the teams-of-teams criterion did not directly map, though teams-of-teams can be considered under Team Size (which is a sub-feature of Team Structure).

A correlation was observed between the teams-of-teams criterion and team size. Generally, the larger the team size, the higher the probability of teams-of-teams. Many of the tactical simulations involved teams-of-teams. This was expected, as the tactical simulations typically occurred at the battalion or brigade level. An example of a large, tactical, teams-of-teams platform would be One Semi-Automated Forces (OneSAF) (see A-7). This system has been employed in the past by the Canadian Forces for tactical battle simulations involving joint (air and land) teams-of-teams.

A common characteristic of teams-of-teams platforms is that the majority of these platforms' primary purpose was for training (not for team research or experiments). Since many of the platforms utilized teams-of-teams for training purposes, performance of teams-of-teams in achieving a common goal is evidently important to measure. In addition to studying teams-of-teams performance, another possible reason why teams-of-teams was utilized in training simulations could be for time and costs savings to train people all at one time versus multiple training sessions for smaller teams. An example of this type of platform is the Cirrus Mine Hunting Simulation System (see A-43). Simulated sonar consoles support basic training of students in the control of their ship-fit mine hunting sonar and associated tactical data management system (Freed, 2005). The training network consists of 10 consoles for the bulk training and is also offered in 3x3 mode for teams-of-teams training.

A major strength of teams-of-teams platforms is that it is flexible in team composition. Team size can vary from small to large. A weakness is that with this added flexibility, there is potential to lose experimental control if the conduct of the experiment is not adequately planned and tested. Another weakness of teams-of-teams platforms is that communication tracking may

be more difficult as it occurs both between and within teams. In particular, a lot of intra-team communication may occur face-to-face rather than electronically.

4.7. Level of Activity

One focus of this survey of experimental platforms was to identify Operational and/or Strategic platforms. Many of the team platforms in the military domain that exist today are used primarily for team training. As a result, many of these platforms were designed for activities at the tactical level.

Several of the platforms that were designed for tactical training, also incorporated training on operational and strategic planning. For example, the Marine Corps Air Ground Task Force (MAGTF) Marine Tactical Warfare Simulation (see A-18) is a computer-assisted exercise support tool designed to support Marine Corps commanders and their staffs. MTWS is used in Command Post Exercises where combat forces, supporting arms, and results of combat are modelled by the system (Operations and Training, 2005). MTWF is used as an operational planning tool to evaluate a plan under alternative enemy or environmental conditions, and can be used as a tool to assess decision making, (Kish, 2002).

There is a high demand for this type of multi-purpose training tool in the military, and it continues to grow and develop. Consequently, operational and strategic scenarios should be a focus in a new team modelling platform. The strength of any such platform is that knowledge about different levels of activity is currently in demand by the military. However, a weakness is that, with each step up in the level of activity, the complexity of the scenario, the size of the team and the sophistication of the technology required to adequately exercise it will grow. The experimenters must strike a balance between the level of activity to study, and the complexity of the experimental platform needed to support such study.

4.8. Team Size

Twenty of the 44 platforms reviewed involved small team sizes. It was observed that platforms using small team sizes were primarily designed and used for team research. It is hypothesized that this is because smaller teams are easier to manage and observe. Team performance measures can be tracked more easily and analyzed in smaller teams. With a smaller team size, it is more likely to have fewer interactions to track among team members. Smaller teams were also observed to be used in more operational and/or strategic scenarios, rather than tactical scenarios. The majority of platforms that used small team sizes did not satisfy the interagency and the joint criteria. This was anticipated, since tasks or scenarios involving smaller team sizes are unlikely to involve team members across multiple agencies. The only platforms that opposed this trend were NeoCITIES (interagency; see A-6) and DDD (joint and interagency; see A-4).

There was no apparent trend in terms of domain or level of activity for platforms with medium team sizes. Only 8 of the platforms reviewed used medium team sizes. It is interesting to note that all platforms with medium teams satisfied the interdisciplinary and distributed criteria. This is an area for future consideration as it is unclear whether this is a function of team size, task demands or some other factor.

Large team sizes (3 out of 44 platforms reviewed) were seen primarily in tactical platforms. Large team sizes also seemed to involve large, complex scenarios. For example, one of the Highly Relevant platforms was the AOC (see A-2), which is characterised by its many varied and complex interactions between team members. It is interesting to note that all platforms with large teams satisfied the interdisciplinary, joint, distributed, and teams-of-teams criteria.

Platforms that involved scaleable team sizes (12 out of 44 platforms reviewed) were flexible in terms of scenarios and operator tasks. It was observed that the primary purpose for the platforms using scaleable team sizes was usually for training or video games. Almost all of these platforms satisfied the ad hoc criterion. This was expected, due to the flexible nature of platforms with scaleable team sizes.

4.9. Platform Fidelity

Of the platforms reviewed in this search, the fidelity of the simulations varied from low to high. Many of the tactical simulations were high fidelity, while the strategic and/or operational platforms were low to medium.

Because the tactical simulations were primarily for training, it was extremely important that these simulations emulate the environment as closely as possible. High fidelity simulations were necessary in order to give trainees exposure to realistic situations and circumstances. This issue is not as much of a concern in platforms with the primary purpose of team research. Team research platforms focus more on data capture and observation. Thus, these platforms should maintain a certain level of fidelity, but more importantly they must be able to manipulate experimental factors in a meaningful way, as well as observe and capture data accurately. The level of fidelity does not need to be high to capture the essence of the task or team performance. Basically, the platform needs to simulate the environment to the degree that a task can be carried out successfully.

There is some advantage to having a medium fidelity simulation versus a low fidelity one. Low fidelity platforms are excellent in data capture, however, this somewhat limits the capabilities of the simulation due to the lower number of variables that can be manipulated. Some examples of low fidelity platforms include: TANDEM, a tactical navy decision making system (see A-19); TITAN, a team and individual tactical assessment network (see A-20); Bolo, a multi-player battle game (see A-25)l Comanche 2.0, a helicopter flight and combat simulator (see A-26); Falcon 3.0, a flight simulator (see Annex-30); and TEAMSim, a team event-based adaptive multilevel simulation (see A-41). A common element of these low fidelity platforms is the ability to only manipulate a few variables at one time and simulate a simplified version of a realistic task. TANDEM, TITAN, and TEAMSim are similar in that they are classification tasks to determine whether targets are benign, and all three platforms are used to study decision-making. Some examples of medium fidelity platforms include: AOC (see A-2), DDD (see A-4), NeoCITIES (see A-6), ADMS (see A-10), ARTT (see A-12), MTWS (see A-18), BMC2 (see A-24), Full Spectrum Warrior (see A-31), and METI (see A-38). Most of these platforms are primarily operational and/or strategic.

4.10. Independent and Dependent Variables

The literature review conducted by Sartori et al (2006) uncovered a number of variables relevant to team research. The variables addressed by each platform surveyed are documented on the data sheets in Annex A. A summary of the findings is presented below. It should be noted that Team Factors and Task Factors, although they can be measured, should be considered more appropriately as independent variables that can be manipulated to change outcomes. These will be discussed in the subsequent sections in addition to the abovementioned factors.

It should be noted however, that the factors affecting performance are often quite specific to the scenario, therefore it is difficult to specify how factors for the future team research platform can be operationalised or measured. Instead, they will be discussed in more detail in Volume II of this report, which covers scenarios used in the past for team research, and makes recommendations for future scenarios and associated factors. A brief mention is made however, of different methods of data collection.

4.10.1. Team Factors

Team factors were explored in each platform. Many of the platforms addressed the Cognitive Ability team factor (34%). This includes spatial orientation, general reasoning ability, and verbal comprehension. A few of the platforms addressed the Team Diversity factor (27% heterogeneous teams and 14% homogenous teams). It was expected that more platforms would address this factor, since diversity generally presents challenges in team performance. Furthermore, team diversity (such as age, gender, culture) is a relatively easy variable to manipulate. Although an experimenter could use a team with diverse participants to manipulate this variable, the platform would need to be sensitive to variations in performance attributable to team diversity. In a constructive simulation, variables would need to be input to generate a diverse team.

Another factor that was infrequently addressed was Leadership (20% transactional leadership and 2% transformational leadership). This was anticipated because not many team research platforms focus on leadership style. The team factor that was the most infrequently addressed was Personality. This includes personality traits such as agreeableness (5%), conscientiousness (5%), and emotional stability (5%). These factors are more difficult to manipulate, as it would require in-depth screening of team members in a real or virtual simulation or in-depth programming in a constructive simulation.

4.10.2. Task Factors

Many of the platforms did not seem to address Task Complexity (as defined in Sartori et al, 2006). Information was either missing or it had to be assumed based on the task type. Most platforms did address the task characteristic of Workload, in terms of specifying or manipulating the type of workload. The most popular workload types were physical (30%) and cognitive workloads (45%). One other form of workload that was frequently considered was workload due to time pressure (20%).

4.10.3. Team Processes

Team processes were recorded for each platform, as they can have a great impact on team performance. A number of platforms were capable of monitoring shared knowledge. This topic is seemingly increasing in popularity as teams realize the impact of "who-knows-what" within the team can greatly influence team performance. NeoCITIES (see A-6), CERTT (see A-13), and Comanche 2.0 (see A-26), were platforms with specified scenarios focusing on shared knowledge. Several platforms measured shared knowledge in the form of Mental Models (27%). Shared knowledge can be manipulated by limiting the communication between team members, or limiting the information available to team members. For example, by controlling the data that appears at each workstation screen or simply by restricting access to specific communication, shared knowledge can be controlled.

Communication was a major team process that many of the platforms addressed. Communication frequency could be manipulated in 30% of the platforms. For example, AEDGE (see A-1), AOC (see A-2), NASA Ames Centre (see A-5), ARTT (see A-12), were platforms that could monitor or vary communication frequency and media.

Adaptability was rarely addressed by any of the platforms, and was characterized by Monitoring (11%) and Backing-Up (5%). CERTT was one platform that measured Adaptability as one of the team process variables. Since Adaptability is difficult to measure (it is a more subjective measure) and it relies on team monitoring and correcting, it was not anticipated to be found in many of the platforms.

Allocation of Resources in Planning was a key team process that was commonly addressed by the platforms (20%). OneSAF (see A-7), ARTT, CATT (see A-14), JTLS (see A-17), MTWS (see A-18), WARSIM (see A-21), and Longbow2 (see A-34), were tactical platforms that had scenarios involving Resource Allocation. This team process was found in many tactical platforms, as it had to be decided how to allocate resources, for example weapons, at this level. NeoCITIES was the only strategic/operational platform that utilized a dedicated primary Resource Allocation task.

Lastly, Team Climate was not addressed frequently by the platforms. This was expected since Team Climate is difficult to measure and manipulate within a platform. The NASA Ames Center platform was able to monitor Trust and Cohesion through subjective measures as well as facial affect measures. ARTT and Bolo (see A-25) were the only platforms that addressed Collective Efficacy. Morale, Motivation, and Cohesion were not addressed by any platform except for Archimedes (see A-42). Archimedes is a constructive platform that had the capability to program and monitor morale and cohesion.

4.10.4. Data Collection

The majority of platforms utilized automatic (via computer) data capture to measure the dependent variables. About 48% of the platforms used computer based data collection. A couple of the platforms utilized Self-Report (5%), whereby at the end of the simulation, users would answer a questionnaire regarding their performance. About 20% of the platforms utilized observer based data collection.

Other platforms used a combination of computer-captured data and observer measures. This type of measure was seen in the medical simulations, where team performance was evaluated by outside observers.

4.11. Other Notable Observations

Unique capabilities were important to identify in order to examine these characteristics in the context of a new team research platform for the CF. Because the military will increasingly interact with other domains (e.g. non-government organizations) it was beneficial to examine team research platforms from all domains.

Unique characteristics identified for the reviewed platforms support recommendations for characteristics to include or to consider in a new team research platform. The following summarizes and discusses the findings of unique capabilities:

- The AEDGE (see A-1) platform had the unique capability of being able to examine individual performance in a complex team setting. The study of individual performance could be of interest to the CF. The new platform should be amendable to this type of capability. AEDGE also used voice recognition and response. This type of communication medium may be considered based on the scenario.
- OneSAF (see A-7) had a Mission Planning and Rehearsal System (MPARS) that was a unique capability that should be considered in Operational and/or Strategic levels of activity.
- ADMS (see A-10) identified a unique configuration of interagency interfaces. This type of capability should be considered in the new team research platform because it supports distributed and interagency teams. Each party involved should have a customized individual interface.
- Dangerous Waters (see A-27) was a video game platform that allowed the interaction and control over multiple (air, land, and maritime) platforms. This capability should be considered because it supports joint teams.
- The Rhode Island Hospital Simulation Centre (see A-35) utilized one-way mirrors to observe medical trainees using the SimMan™. This method of observation may be desirable for a new team research platform. This would be especially beneficial if subjective evaluation or exact real-time monitoring of objective measurements is required.
- DDD (see A-4) had the capability to easily manipulate task loads. Task load refers to the objective amount of demand placed upon the user by the scenario. The user's perception of the workload associated with the scenario will vary with the skill level, mood, fatigue and capabilities of the user. Consequently, the user's workload (e.g. physical, cognitive, temporal) can be easily investigated. The number, type, timing and uncertainty associated with the tasks that need to be processed can be manipulated. Organizational structures can also be manipulated by changing authority levels, ownership of assets, communication variables, information availability variables and team membership variables (Galster et. al, 2005). All of these capabilities should be considered for a new team research platform if variables such as authority levels, communication, and information availability, are desirable manipulations.

- Lastly, FIRSTplus Radar Air Traffic Controller (see A-29) had the unique capability to create user-defined environments. This capability may be advantageous if the new team research platform were to have different variations of the same scenario, by only manipulating environmental conditions.

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5. Conclusions and Recommendations

The objectives of this report were to identify and characterize different team research platforms in support of military operations (or related applications), review the different team research platforms in terms of criteria identified by the team literature review; and identify requirements for a new experimental platform that will support experiments that are representative of the targeted teamwork context. This section considers the findings of the platform review and provides recommendations for a new team research platform for the 4-year Applied Research Project on Modelling Team Performance.

5.1 General Findings

The review of platforms proved to be a valuable task. Commonalities between the capabilities of different types of platforms were analyzed. Further, a number of unique features were identified. A number of conclusions are provided below, structured according to the six criteria (ad hoc, interdisciplinary, interagency, joint, distributed, teams-of-teams).

The most flexible type of platform was determined to be one that supports ad hoc teams. Flexibility ranged from variable team sizes to types of scenarios that can be created within the platform. In contrast, all interdisciplinary platforms seemed to define very specific roles for their team members. Interagency platforms had well defined types of scenarios that were designed for emergency response or crisis management. The issue that confronts the experimental team is how to effectively represent the flexibility of ad hoc teams, while providing for the strict definition of roles associated with interdisciplinary teams. To accommodate this, the experimental platform should provide many different ways for team members to communicate and collaborate. Typically, team members may use voice communication, but text, graphic and video should also be provided. Further, the opportunity to share applications over a network should be provided. This may allow teams to work collaboratively to build plans and brainstorm solutions, without necessitating that they crowd around a single workstation.

Distributed platforms require network capability as well. Some of these platforms utilized High-Level Architecture (HLA) or Aggregate Level Simulation Protocol (ALSP) to network to other facilities' platforms. Common elements of distributed platforms include simulation computers and operator consoles networked via Ethernet. A strength of a distributed platform is that its architecture enables scalability of scenarios and multiple concurrent users, such as interagency and joint users. Potential weaknesses would be a network connection failure and different simulation architectures.

There are many similarities between the characteristics of interagency, joint, and distributed platforms. All three types require network capabilities and have the similar strengths and weaknesses. These criteria are somewhat inherent within each other. For example, distributed characteristics support interagency capabilities and joint characteristics support interagency capabilities. It is safe to say that if a platform satisfies the distributed criterion, it will most likely satisfy the interagency and joint criteria in terms of hardware and software requirements.

Teams-of-teams platforms were observed to be those with a primary purpose for training (not for team research). This represents a major opportunity for team research since the performance of

teams-of-teams is in need of investigation. With the increased presence of the media at every event (e.g. war, disasters, crises) it is more likely that the response will include a variety of stable teams, coming together to form a 'super-team'. To overcome the risk of these teams-of-teams unwittingly making a situation worse, it is important that the dynamics and issues surrounding them are understood. This way commanders can act proactively to use the teams-of-teams' resources to their utmost effect.

Each platform in this review was screened for its unique capabilities that may offer insight, and support or extend recommendations for a new team research platform. There were a variety of significant unique capabilities noted in different domains. These include: the new platform should be amendable to the study of individual performance of behaviour, include a Mission Planning and Rehearsal System (MPARS) for a scenario at the Operational and/or Strategic levels, have the capacity for altering the configuration of user interfaces for different agencies, have a capability for interaction over multiple (joint) platforms, use one-way mirrors for subjective or real-time objective observation, have the capability to easily manipulate task loads, and have the capability to create a user-defined environment for a scenario .

The platforms reviewed in this report suggest that there are many more potential capabilities that team research platforms can have. By mapping the platforms to the results of the Sartori et al (2006) report, it was discovered that ; 1. a new research platform for the CF would ideally address more than one of the research areas outlined in Sartori et al (2006), and 2. currently, there is no research platform in existence that would meet all of the criteria deemed important by the SA (and by implication, the requirements for team research to inform future CF operations). Nonetheless, several of the platforms satisfied all of the outlined criteria and each one was unique in terms of its domain and primary area of research. Out of all the platforms reviewed in this study, NeoCITIES was the most relevant platform available. NeoCITIES satisfied all the criteria except for the joint criterion. It is capable of handling ad hoc teams in its emergency crisis management scenario, it involves interagency collaboration (Police, Fire/EMS, HAZMAT), it is distributed, and uses teams-of-teams with the interagency parties. The primary task is resource allocation in an emergency situation, with a study of the impact of hidden knowledge, while handling emergent terrorism events. This type of platform and scenario seems very suitable for addressing the aims of this project.

5.2 Specification of a New Team Research Platform

Upon review of the existing team research platforms, many ideas were generated on capabilities to recommend for a new team research platform. The following recommendations should be considered for the future team research platform:

- The new team research platform should use a medium fidelity simulation. A medium fidelity simulation will achieve an ideal balance between realism and experimental control.
- The platform should be a virtual simulation, however, it should have some constructive capabilities. This would be useful for direct comparison of human to agent performance or for studying human interaction with automated agents (for example, in decision making).

- The level of activity should be operational and/or strategic. This will likely involve executive and command task types.
- The team studied in the new team research platform should be small. This compliments the recommendation to focus on the operational/strategic level of activity. Team size can have some variability, but it is recommended that the team size not exceed the medium level (maximum 19 people).
- The platform should be capable of ad hoc teams. However, this should not be implemented until a solid scenario is detailed.
- The platform should use only interdisciplinary teams. This compliments the team size recommendation.
- The platform should be capable of distributed teams. If the platform meets the requirements to be distributed, it will inherently be capable of interagency and joint teams from a technical standpoint.
- The platform should be capable of teams-of-teams. However, this should not be implemented until a solid scenario is detailed.
- If the platform will have the distributed and teams-of-teams capabilities, customized communication channels should be implemented. It is recommended that multiple communication media be available (e.g., message board, chat/type, radio, face-to-face, etc.) and the communication frequency, as well as technology be chosen specific to each scenario.
- The platform should address team diversity. This can range from surface level diversity (age, gender, etc.) to the inclusion of joint and interagency team members.
- The new platform should be capable of manipulating / measuring different types of workload. The recommended types of workload that it should addressed are physical, cognitive, and time pressure.
- The new platform should be able to support interoperability across environments (air, maritime, land) and with allies, other government departments, and/or non-government organizations. However, the issue of security should be addressed. If numerous agencies are working together and continuously sharing information, one needs to question how access to data should be restricted. None of the platforms capable of interagency, joint, or distributed reviewed in this study addressed the issue of security.
- The new platform should be amenable to upgrades and future expansions. There is evidently the need for open architecture that will enable a platform to interact with another platform or have the capability to simply be upgraded.
- The new platform should be capable of manipulating / measuring team processes such as shared knowledge, communication, planning, and coordination. These are fundamental to operational/strategic tasks.

These recommendations for a new team research platform will address the four core research areas for DRDC in the next 5-10 years:

- Improve ability of CF to work with other agencies in domestic and deployed operations – Implementing an interagency, and joint platform will achieve this.
- Improve ability to work in distributed team environments – Implementing a distributed platform will achieve this.
- Improve ability to work in culturally diverse environments – Addressing team diversity will achieve this.
- Improve the training and learning of teams in distributed environments - Implementing a distributed platform and monitoring the team processes (shared knowledge, communication, planning, and coordination) will achieve this.

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Annex A:
Platform Data Sheets

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Platform Name: Agent Enabled Decision Group Environment (AEDGE)
Reference Number: 1
Organization: Air Force Research Laboratory
Relevance: Highly Relevant
Domain: Command and Control

Customized Workstations	☐	Ad Hoc:	Yes
Communication Channels	☑	Interdisciplinary:	Yes
Customized Scenarios	☑	Interagency:	No
Platform Type:	Constructive and Virtual	Joint:	Yes
Fidelity:	High	Distributed:	Yes
Team Size:	Medium	Teams of Teams:	Yes
Primary Purpose:	Decision Making	Level of Activity:	Strategic/Operational

Platform Description:
The software, built using 21st Century Systems Inc.'s AEDGE infrastructure, is a distributed, real-time team decision support environment comprised of simulators, entity framework, intelligent agents and user interfaces. The AEDGE was developed based on cognitive and functional analysis of C3 mission, tactics, team member roles, and role interdependencies. The behavior and decision making of all hostile and friendly entities not controlled by humans is directed by agent-based technology. If a human decides to "log in" as a particular entity, he/she may choose to view recommendations generated by the agent for that entity. Even if the human operator chooses not to view recommendations, the agent

Operator/Task Description:
The AWACS AEDGE (Agent-Enabled Decision Group Environment) is a simulation of the weapons director roles within the Airborne Warning and Control System. The AWACS/AEDGE was developed to represent core characteristics of the Airborne Warning and Control System (AWACS) Weapons Director (WD) team.

1 Team Factors

- 1.1 Team Structure
  - 1.1.1 Leadership
    - Transactional ☑
    - Transformational ☐
- 1.2 Team Composition
  - 1.2.1 Individual Traits
    - 1.2.1.1 Personality
      - Agreeableness ☐
      - Conscientiousness ☐
      - Emotional stability ☐
      - Extraversion ☐
      - Openess ☐
    - 1.2.1.2 Cognative ability
      - General cognative ability ☑
      - Spatial orientation ☑
      - Verbal comprehension ☑
      - Reasoning ability ☑
  - 1.2.2 Team Diversity
    - Heterogenous ☑
    - Homogenous ☐

2 Task Factors

- 2.1 Task Type
  - Additive ☑
  - Conjunctive ☐
  - Disjunctive ☐
  - Discretionary ☐
  - Executive ☐
  - Command ☑
  - Negotiation ☐
  - Commissions ☐
  - Advisory ☐
  - Design ☐
- 2.2 Task Characteristics
  - 2.2.1 Task Complexity
    - Scope ☑
    - Structurability ☐
    - Uncertainty ☐
  - 2.2.2 Workload
    - Physical ☐
    - Cognitive ☑
    - Emotional ☐
    - Time pressure ☐
  - 2.2.3 Task Interdependence ☑

3 Team Intervention

- 3.1 Team Training
  - Cross training ☐
  - Team coordination training ☐
  - Team self-correction ☐
  - Assertiveness training ☐
- 3.2 Team Building ☐
- 3.3 Feedback and Goal Setting ☐

4 Team Processes

- 4.1 Shared Knowledge
  - 4.1.1 Mental Models ☐
  - 4.1.2 Situational Awareness ☐
  - 4.1.3 Transactive memory ☐
- 4.2 Communication
  - 4.2.1 Need
    - Communication Frequency ☑
    - Team Structure ☐
  - 4.2.2 Efficiency
    - Anticipation Ratios ☐
    - Team Structure ☐
  - 4.2.3 Technology ☑
  - 4.2.4 Type
    - Implicit vs. Explicit ☐
    - Heterogen vs. Homogen ☐
- 4.3 Team Adaptability
  - 4.3.1 Error Correction ☐
  - 4.3.2 Monitoring ☐
  - 4.3.3 Backing-Up ☐
- 4.4 Planning
  - 4.4.1 Allocation of Resources ☑
    - Personnel ☐
    - Time ☐
    - Material ☐
    - Energy ☐
- 4.5 Coordination
  - Interdependence ☐
  - Team structure ☐
  - Resource allocation ☐
  - Communication ☐
  - Mental Models ☐
- 4.6 Team Climate
  - Morale ☐
  - Motivation ☐
  - Trust ☐
  - Cohesion ☐
  - Collective Efficacy ☐

5 Measures

- 5.1 Outcome
  - Computer ☑
- 5.2 Process
  - Self-Report ☐
  - Observer ☑
- 5.3 Level of Analysis
  - 5.3.1 Individual ☑
  - 5.3.2 Team ☑
  - Collective vs. Holistic ☐

Discussion/Observations
The AEDGE is constructed as a federation of intelligent agent-based functions that enable user-friendly scenario construction, emulation of friendly and hostile entities, and dynamic scenario control. The AEDGE platform (Agent-Enabled Decision Group Environment) is a highly configurable C3 platform that uses intelligent agent technology to enhance simulation realism, decision support, and experimental manipulations. A unique aspect to the agent-based task is the capability of agents to "play" any role in a given scenario, thus allowing the study of individual performance in a complex but controlled team setting. Another aspect is voice recognition and response, where human voice commands direct simulation tasks, and agent based communications can be heard.

Source: http://dodccrp.org/events/2002/7th_ICCRTS/Tracks/pdf/113.pdf

Platform Name: Air Operation Centers (AOC)
Reference Number: 2
Organization: U.S. Air Force Research Lab
Relevance: Highly Relevant
Domain: Air Force

Customized Workstations	☑	Ad Hoc:	Yes
Communication Channels	☑	Interdisciplinary:	Yes
Customized Scenarios	☑	Interagency:	Yes
Platform Type:	Constructive and Virtual	Joint:	Yes
Fidelity:	Medium	Distributed:	Yes
Team Size:	Large	Teams of Teams:	Yes
Primary Purpose:	Decision Making	Level of Activity:	Strategic/Operational

Platform Description:

Air Operations Centers (AOC) are pivotal to planning, control, and execution of an aerospace campaign. They are the nerve centers, the command and control nodes, for theater aerospace combat power. In wartime, these highly complex organizations deal with staggering amounts of information - often more than can be processed. The purpose of this program is to create innovative work support systems to improve decision-making within the AOC. The idea is to allow decisions to be made and plans to be formulated more quickly by providing users with intuitive, high-level visualizations of mission effects, interrelationships and mechanisms. The end result will be improved planning and assessment within the air tasking order (ATO) cycle.

Operator/Task Description:

No specific scenarios were identified. The vertical interactions to be considered include the Joint Task Force (JTF) Commander, the Joint Forces Air Component Commander (JFACC), and the AOC Director. The horizontal interactions to be considered include the cells/organization/agencies with whom the Strategy Plans and Operational Assessment teams provide information to and get information from - both on the floor and in reachback/reachforward locations.

1 Team Factors

- 1.1 Team Structure
  - 1.1.1 Leadership
    - Transactional ☐
    - Transformational ☐
- 1.2 Team Composition
  - 1.2.1 Individual Traits
    - 1.2.1.1 Personality
      - Agreeableness ☐
      - Conscientiousness ☐
      - Emotional stability ☐
      - Extraversion ☐
      - Openess ☐
    - 1.2.1.2 Cognative ability
      - General cognative ability ☑
      - Spatial orientation ☐
      - Verbal comprehension ☐
      - Reasoning ability ☑
  - 1.2.2 Team Diversity
    - Heterogenous ☑
    - Homogenous ☑

2 Task Factors

- 2.1 Task Type
  - Additive ☐
  - Conjunctive ☐
  - Disjunctive ☐
  - Discretionary ☐
  - Executive ☑
  - Command ☑
  - Negotiation ☐
  - Commissions ☐
  - Advisory ☐
  - Design ☐
- 2.2 Task Characteristics
  - 2.2.1 Task Complexity
    - Scope ☐
    - Structurability ☐
    - Uncertainty ☐
  - 2.2.2 Workload
    - Physical ☐
    - Cognitive ☑
    - Emotional ☐
    - Time pressure ☐
  - 2.2.3 Task Interdependence ☐

3 Team Intervention

- 3.1 Team Training
  - Cross training ☐
  - Team coordination training ☐
  - Team self-correction ☐
  - Assertiveness training ☐
- 3.2 Team Building ☐
- 3.3 Feedback and Goal Setting ☐

4 Team Processes

- 4.1 Shared Knowledge
  - 4.1.1 Mental Models ☑
  - 4.1.2 Situational Awareness ☑
  - 4.1.3 Transactive memory ☐
- 4.2 Communication
  - 4.2.1 Need
    - Communication Frequency ☐
    - Team Structure ☑
  - 4.2.2 Efficiency
    - Anticipation Ratios ☐
    - Team Structure ☐
  - 4.2.3 Technology ☐
  - 4.2.4 Type
    - Implicit vs. Explicit ☐
    - Heterogen vs. Homogen ☐
- 4.3 Team Adaptability
  - 4.3.1 Error Correction ☐
  - 4.3.2 Monitoring ☐
  - 4.3.3 Backing-Up ☐
- 4.4 Planning
  - 4.4.1 Allocation of Resources ☐
    - Personnel ☐
    - Time ☐
    - Material ☐
    - Energy ☐
- 4.5 Coordination
  - Interdependence ☐
  - Team structure ☐
  - Resource allocation ☐
  - Communication ☐
  - Mental Models ☐
- 4.6 Team Climate
  - Morale ☐
  - Motivation ☐
  - Trust ☐
  - Cohesion ☐
  - Collective Efficacy ☐

5 Measures

- 5.1 Outcome
  - Computer ☐
- 5.2 Process
  - Self-Report ☐
  - Observer ☐
- 5.3 Level of Analysis
  - 5.3.1 Individual ☐
  - 5.3.2 Team ☐
  - Collective vs. Holistic ☐

Discussion/Observations

Special attention will be given to the interaction between the strategy planning team and the operational assessment team. The analyses of these various work environments includes analysis of:
- work domains - an understanding of the essential information and how that information should be organized **(mental models)**
- tasks and strategies - deeper understanding of information organization and how it should be represented to be used **(cognitive ability, reasoning ability)**
- teams organization - understanding of interaction patterns in the workspace - interactions among team/AOC/reachback members and interactions with tools (**team structure**).

One of the important outcomes of this effort will be the identification of critical measures of performance (i.e., key performance factors) that can be used as metrics for Strategy Division tools and organizations.
(Lacking information regarding methods of data collection and measures).

Source: http://www.hec.afrl.af.mil/Organization/HECP/AOC.asp

Platform Name: AWACS in the C3STARS Facility
Reference Number: 3
Organization: Air Force Research Laboratory, Mesa, Arizona
Relevance: Highly Relevant
Domain: Air Force

Customized Workstations	☑	Ad Hoc:	Capable
Communication Channels	☑	Interdisciplinary:	Capable
Customized Scenarios	☑	Interagency:	No
Platform Type:	Virtual	Joint:	Yes
Fidelity:	High	Distributed:	Yes
Team Size:	Small	Teams of Teams:	No
Primary Purpose:	Team Experiments	Level of Activity:	Operational

Platform Description:
The Command, Control, and Communications Simulation, Training, and Research System (C3STARS) facility offers the opportunity to investigate complex decision making among interdependent team members within a dynamic and realistic setting. The crew stations and scenarios simulate the air defence mission of an Airborne Warning and Control System (AWACS) platform. Realism is achieved through the functional representation of equipment and displays, experienced personnel playing the role of simulation pilots, and the use of operational scenarios.

Operator/Task Description:
No specific scenarios were identified.

1 Team Factors

- 1.1 Team Structure
  - 1.1.1 Leadership
    - Transactional ☐
    - Transformational ☐
- 1.2 Team Composition
  - 1.2.1 Individual Traits
    - 1.2.1.1 Personality
      - Agreeableness ☐
      - Conscientiousness ☐
      - Emotional stability ☐
      - Extraversion ☐
      - Openess ☐
    - 1.2.1.2 Cognative ability
      - General cognative ability ☑
      - Spatial orientation ☐
      - Verbal comprehension ☐
      - Reasoning ability ☐
  - 1.2.2 Team Diversity
    - Heterogenous ☐
    - Homogenous ☐

2 Task Factors

- 2.1 Task Type
  - Additive ☐
  - Conjunctive ☐
  - Disjunctive ☐
  - Discretionary ☐
  - Executive ☑
  - Command ☑
  - Negotiation ☐
  - Commissions ☐
  - Advisory ☐
  - Design ☐
- 2.2 Task Characteristics
  - 2.2.1 Task Complexity
    - Scope ☐
    - Structurability ☐
    - Uncertainty ☐
  - 2.2.2 Workload
    - Physical ☑
    - Cognitive ☑
    - Emotional ☐
    - Time pressure ☐
  - 2.2.3 Task Interdependence ☐

3 Team Intervention

- 3.1 Team Training
  - Cross training ☐
  - Team coordination training ☐
  - Team self-correction ☐
  - Assertiveness training ☐
- 3.2 Team Building ☐
- 3.3 Feedback and Goal Setting ☐

4 Team Processes

- 4.1 Shared Knowledge
  - 4.1.1 Mental Models ☑
  - 4.1.2 Situational Awareness ☑
  - 4.1.3 Transactive memory ☐
- 4.2 Communication
  - 4.2.1 Need
    - Communication Frequency ☑
    - Team Structure ☐
  - 4.2.2 Efficiency
    - Anticipation Ratios ☐
    - Team Structure ☐
  - 4.2.3 Technology ☐
  - 4.2.4 Type
    - Implicit vs. Explicit ☐
    - Heterogen vs. Homogen ☐
- 4.3 Team Adaptability
  - 4.3.1 Error Correction ☐
  - 4.3.2 Monitoring ☐
  - 4.3.3 Backing-Up ☐
- 4.4 Planning
  - 4.4.1 Allocation of Resources ☑
    - Personnel ☐
    - Time ☐
    - Material ☐
    - Energy ☐
- 4.5 Coordination
  - Interdependence ☑
  - Team structure ☐
  - Resource allocation ☑
  - Communication ☑
  - Mental Models ☑
- 4.6 Team Climate
  - Morale ☐
  - Motivation ☐
  - Trust ☐
  - Cohesion ☐
  - Collective Efficacy ☐

5 Measures

- 5.1 Outcome
  - Computer ☑
- 5.2 Process
  - Self-Report ☐
  - Observer ☑
- 5.3 Level of Analysis
  - 5.3.1 Individual ☑
  - 5.3.2 Team ☑
  - Collective vs. Holistic ☐

Discussion/Observations
This facility provides the capability to represent a wide variety of weapon systems and training scenarios to include: Rivet Joint, JSTARS, AWACS, Uninhabited Air Vehicles, and Satellite Tracking and Surveillance systems. These capabilities are available to perform research in the following areas: 1) Distributed Mission Training (2) Team Performance Measurement (3) Training Effectiveness Research (4) Information Analysis (5) Intelligent Agent Models (6) Space-Based Surveillance Systems.

The C3STARS facility is able to support air, space, and information warfighter training while making that training affordable and realistic.

Metrics span the different levels of analysis from individual capability and individual performance to more team-level processes and outcomes such as **team communication effectiveness** and **Distributed Mission Training (DMT) effectiveness**. Systems-team performance measures include those interdependent behaviors that directly affect measures of mission effectiveness. For example, one measure is the degree to which the team is successful at directing interceptor aircraft to defeat enemy aircraft. Also studies individual performance.

Source: http://www.mesa.afmc.af.mil/html/c3stars.htm

Platform Name: Distributed Dynamic Decision Making (DDD)
Reference Number: 4
Organization: Aptima
Relevance: Highly Relevant
Domain: Command and Control

Customized Workstations	☑	Ad Hoc:	Yes
Communication Channels	☑	Interdisciplinary:	Yes
Customized Scenarios	☑	Interagency:	Yes
Platform Type:	Virtual	Joint:	Yes
Fidelity:	Low to Medium	Distributed:	Yes
Team Size:	Small	Teams of Teams:	No
Primary Purpose:	Team Experiments	Level of Activity:	Strategic/Operational

Platform Description:
The Distributed Dynamic Decision-making (DDD) team-in-the-loop simulation is the product of a team research program that has been underway for almost 15 years. The DDD is a unique distributed multi-person simulation and software tool for understanding how high-performance teams operate in complex environments. The DDD was designed to capture the essential elements of many different team tasks, and allow the experimenter to vary team structure, access to information, and control of resources. It has been used to simulate military decision-making environments (e.g., Joint Task Force, AWACS), industrial environments (e.g. manufacturing systems, civilian search and rescue) and even health care applications (e.g. distributed diagnosis).

Operator/Task Description:
From empirical study (Ellis et. al): Team members in a four person team, were to monitor activity in a geographic region and defend it against invasion from unfriendly air or ground tracks. Each team member is referred to as a decision maker. The objective is to identify any tracks that entered their space (split into 4 quadrants) and determine whether they are friendly or unfriendly. In this version, participants were seated in close proximity at four networked computer terminals. Verbal communication was the only method of communication allowed during the task and they were free to communicate as frequently as they wanted.

1 Team Factors

- 1.1 Team Structure
  - 1.1.1 Leadership
    - Transactional ☐
    - Transformational ☐
  - 1.2 Team Composition
  - 1.2.1 Individual Traits
    - 1.2.1.1 Personality
      - Agreeableness ☑
      - Conscientiousness ☐
      - Emotional stability ☐
      - Extraversion ☐
      - Openness ☑
    - 1.2.1.2 Cognitive ability
      - General cognitive ability ☑
      - Spatial orientation ☐
      - Verbal comprehension ☑
      - Reasoning ability ☐
  - 1.2.2 Team Diversity
    - Heterogeneous ☐
    - Homogenous ☐

2 Task Factors

- 2.1 Task Type
  - Additive ☐
  - Conjunctive ☐
  - Disjunctive ☐
  - Discretionary ☐
  - Executive ☐
  - Command ☑
  - Negotiation ☐
  - Commissions ☐
  - Advisory ☐
  - Design ☐
- 2.2 Task Characteristics
  - 2.2.1 Task Complexity
    - Scope ☐
    - Structurability ☐
    - Uncertainty ☑
  - 2.2.2 Workload
    - Physical ☐
    - Cognitive ☑
    - Emotional ☐
    - Time pressure ☑
  - 2.2.3 Task Interdependence ☑

3 Team Intervention

- 3.1 Team Training
  - Cross training ☐
  - Team coordination training ☐
  - Team self-correction ☐
  - Assertiveness training ☐
- 3.2 Team Building ☐
- 3.3 Feedback and Goal Setting ☐

4 Team Processes

- 4.1 Shared Knowledge
  - 4.1.1 Mental Models ☐
  - 4.1.2 Situational Awareness ☐
  - 4.1.3 Transactive memory ☐
- 4.2 Communication
  - 4.2.1 Need
    - Communication Frequency ☑
    - Team Structure ☑
  - 4.2.2 Efficiency
    - Anticipation Ratios ☐
    - Team Structure ☑
  - 4.2.3 Technology ☐
  - 4.2.4 Type
    - Implicit vs. Explicit ☐
    - Heterogen vs. Homogen ☐
- 4.3 Team Adaptability
  - 4.3.1 Error Correction ☐
  - 4.3.2 Monitoring ☑
  - 4.3.3 Backing-Up ☐
- 4.4 Planning
  - 4.4.1 Allocation of Resources ☑
    - Personnel ☐
    - Time ☐
    - Material ☐
    - Energy ☐
- 4.5 Coordination
  - Interdependence ☐
  - Team structure ☐
  - Resource allocation ☐
  - Communication ☐
  - Mental Models ☐
- 4.6 Team Climate
  - Morale ☐
  - Motivation ☐
  - Trust ☐
  - Cohesion ☐
  - Collective Efficacy ☐

5 Measures

- 5.1 Outcome
  - Computer ☑
- 5.2 Process
  - Self-Report ☐
  - Observer ☐
- 5.3 Level of Analysis
  - 5.3.1 Individual ☐
  - 5.3.2 Team ☐
  - Collective vs. Holistic ☐

Discussion/Observations

From emperical study: On the basis of the literature regarding attentional capacity, constructive controversy, and truth-supported wins, the authors examined the effects of cognitive ability, workload distribution, Agreeableness, Openness to Experience, and structure on team learning. Results from 109 four-person project teams working on an interdependent **command and control simulator** indicated that teams learned more when composed of individuals who were high in cognitive ability and when the workload was distributed evenly. Conversely, team learning was negatively affected when teams were composed of individuals who were high in Agreeableness.

DDD Platform is ideal to understand how high-performance teams operate in complex decision-making environment. The task loads in DDD scenarios can easily be manipulated by changing the number, type, timing and uncertainty associated with the tasks that need to processed. Additionally, organizational structures can be manipulated by changing authority levels, ownership of assets, communication variables, information availability variables and team membership variables.

Sources: http://www.aptima.com/Projects/Distributed_Dynamic_Decision_making.html
http://www.dodccrp.org/events/2005/10th/CD/papers/358.pdf
Article: "Team Learning: Collectively Connecting the Dots," Ellis, Porter, Hollenbeck, Ilgen, West and Moon, 2003

Platform Name: NASA Ames Centre- Distributed Research Facilities
Reference Number: 5
Organization: NASA
Relevance: Highly Relevant
Domain: Space

Customized Workstations	☑	Ad Hoc:	Capable
Communication Channels	☑	Interdisciplinary:	Capable
Customized Scenarios	☑	Interagency:	Capable
Platform Type:	Virtual	Joint:	No
Fidelity:	High	Distributed:	Capable
Team Size:	Small	Teams of Teams:	No
Primary Purpose:	Team Experiments	Level of Activity:	Strategic

Platform Description:
A computer-based simulated search and rescue mission set in Antarctica (or Mars) was developed to study team interaction and decision making performance. Team and task stressors are manipulated along with team composition (gender and national culture). Time synchronized data (computer-based task performance, physiological measures, audio and video recordings) support analyses of team processes and outcomes, including responses to task and interpersonal stress. Questionnaire data (workload, team dynamics and individual difference measures, e.g., personality and cognitive processes) provide essential information concerning team composition, leadership and performance both at the individual and team

Operator/Task Description:
Teams composed of four or five members engage in an Antarctic or Mars search mission over a period of four days (one day of training, three days involving six simulations). Teams work together to locate a lost party sent to repair a malfunctioning communication antenna. Teams must develop plans and strategies, share information, manage resources, and cope with unexpected problems under time pressure.

1 Team Factors

- 1.1 Team Structure
  - 1.1.1 Leadership
    - Transactional ☐
    - Transformational ☐
- 1.2 Team Composition
  - 1.2.1 Individual Traits
    - 1.2.1.1 Personality
      - Agreeableness ☑
      - Conscientiousness ☑
      - Emotional stability ☑
      - Extraversion ☐
      - Openness ☐
    - 1.2.1.2 Cognitive ability
      - General cognitive ability ☑
      - Spatial orientation ☐
      - Verbal comprehension ☑
      - Reasoning ability ☐
  - 1.2.2 Team Diversity
    - Heterogeneous ☑
    - Homogenous ☑

2 Task Factors

- 2.1 Task Type
  - Additive ☐
  - Conjunctive ☐
  - Disjunctive ☐
  - Discretionary ☐
  - Executive ☐
  - Command ☑
  - Negotiation ☐
  - Commissions ☐
  - Advisory ☐
  - Design ☐
- 2.2 Task Characteristics
  - 2.2.1 Task Complexity
    - Scope ☐
    - Structurability ☐
    - Uncertainty ☐
  - 2.2.2 Workload
    - Physical ☑
    - Cognitive ☑
    - Emotional ☑
    - Time pressure ☑
  - 2.2.3 Task Interdependence ☑

3 Team Intervention

- 3.1 Team Training
  - Cross training ☐
  - Team coordination training ☑
  - Team self-correction ☐
  - Assertiveness training ☐
- 3.2 Team Building ☐
- 3.3 Feedback and Goal Setting ☑

4 Team Processes

- 4.1 Shared Knowledge
  - 4.1.1 Mental Models ☐
  - 4.1.2 Situational Awareness ☐
  - 4.1.3 Transactive memory ☐
- 4.2 Communication
  - 4.2.1 Need
    - Communication Frequency ☑
    - Team Structure ☑
  - 4.2.2 Efficiency
    - Anticipation Ratios ☐
    - Team Structure ☐
  - 4.2.3 Technology ☑
  - 4.2.4 Type
    - Implicit vs. Explicit ☐
    - Heterogen vs. Homogen ☑
- 4.3 Team Adaptability
  - 4.3.1 Error Correction ☐
  - 4.3.2 Monitoring ☑
  - 4.3.3 Backing-Up ☐
- 4.4 Planning
  - 4.4.1 Allocation of Resources ☐
    - Personnel ☐
    - Time ☐
    - Material ☐
    - Energy ☐
- 4.5 Coordination
  - Interdependence ☑
  - Team structure ☐
  - Resource allocation ☐
  - Communication ☐
  - Mental Models ☐
- 4.6 Team Climate
  - Morale ☐
  - Motivation ☐
  - Trust ☑
  - Cohesion ☑
  - Collective Efficacy ☐

5 Measures

- 5.1 Outcome
  - Computer ☑
- 5.2 Process
  - Self-Report ☑
  - Observer ☐
- 5.3 Level of Analysis
  - 5.3.1 Individual ☐
  - 5.3.2 Team ☐
  - Collective vs. Holistic ☐

Discussion/Observations
Both task and team stressors are manipulated to induce cognitive and emotional arousal. Task performance, physiological measures (ECG, respiration, SCL, EMG, and PPG), voice and email communication, personality, team dynamics, and **facial affect measures** are being analyzed to identify the relations between stress, team interactions and task performance.

Goals of this study are to (a) determine the effects of task- and team-related stressors on team performance in challenging situations; (b) develop and validate technologies to monitor affective responses of individual team members, and (c) identify effective team interaction strategies. These will establish a basis for countermeasures to prevent deterioration of team performance.

Sources: http://www.nasa.gov/centers/ames/research/technology-onepagers/distributed-team-decision.html
http://www.nsbri.org/Research/Projects/viewsummary.epl?pid=170

Platform Name: NeoCities
Reference Number: 6
Organization: Pennsylvania State University and Purdue University
Relevance: Highly Relevant
Domain: Emergency Services

Customized Workstations	☑	Ad Hoc:	Capable
Communication Channels	☑	Interdisciplinary:	Yes
Customized Scenarios	☑	Interagency:	Yes
Platform Type:	Virtual	Joint:	No
Fidelity:	Medium	Distributed:	Yes
Team Size:	Small	Teams of Teams:	Yes
Primary Purpose:	Team Experiments	Level of Activity:	Operational /Tactical

Platform Description:
The NeoCITIES simulation was created to study decision-making and the impact of hidden knowledge profiles on team performance within a distributed command, control, and communications (C3) setting. NeoCITIES has been designed for the purpose of representing both new and operationally relevant scaled worlds, while emulating the complexities and attributes of emergent decision-making scenarios involving emergent counterterrorism events. .

Operator/Task Description:
For initial empirical testing, participants will be assigned to one of three teams with each team being composed of two team members. Within each of the three teams, there are two team positions: the information manager (IM) and the resource manager (RM). The primary responsibilities for the IM are to process incoming information about event in the city that may need to be addressed, notifying the RM of those events that require action by that team, and communicating information across all of the teams. The primary responsibilities for the RM are to allocate resources, monitor their progress, reallocate them as required, and communicate event status and information generated "on-site" back to the IM. The primary goal of all teams involved is to respond to emerging events, maintain order within their city, and prevent a city-wide catastrophe from being initiated by terrorists and insurgents.

1 Team Factors

- 1.1 Team Structure
  - 1.1.1 Leadership
    - Transactional ☐
    - Transformational ☐
- 1.2 Team Composition
  - 1.2.1 Individual Traits
    - 1.2.1.1 Personality
      - Agreeableness ☐
      - Conscientiousness ☐
      - Emotional stability ☐
      - Extraversion ☐
      - Openness ☐
    - 1.2.1.2 Cognitive ability
      - General cognitive ability ☑
      - Spatial orientation ☐
      - Verbal comprehension ☐
      - Reasoning ability ☑
  - 1.2.2 Team Diversity
    - Heterogeneous ☐
    - Homogenous ☐

2 Task Factors

- 2.1 Task Type
  - Additive ☐
  - Conjunctive ☐
  - Disjunctive ☐
  - Discretionary ☐
  - Executive ☑
  - Command ☑
  - Negotiation ☐
  - Commissions ☐
  - Advisory ☐
  - Design ☐
- 2.2 Task Characteristics
  - 2.2.1 Task Complexity
    - Scope ☐
    - Structurability ☐
    - Uncertainty ☐
  - 2.2.2 Workload
    - Physical ☐
    - Cognitive ☑
    - Emotional ☐
    - Time pressure ☑
  - 2.2.3 Task Interdependence ☐

3 Team Intervention

- 3.1 Team Training
  - Cross training ☐
  - Team coordination training ☐
  - Team self-correction ☐
  - Assertiveness training ☐
- 3.2 Team Building ☐
- 3.3 Feedback and Goal Setting ☐

4 Team Processes

- 4.1 Shared Knowledge
  - 4.1.1 Mental Models ☐
  - 4.1.2 Situational Awareness ☐
  - 4.1.3 Transactive memory ☐
- 4.2 Communication
  - 4.2.1 Need
    - Communication Frequency ☑
    - Team Structure ☑
  - 4.2.2 Efficiency
    - Anticipation Ratios ☐
    - Team Structure ☐
  - 4.2.3 Technology ☐
  - 4.2.4 Type
    - Implicit vs. Explicit ☑
    - Heterogen vs. Homogen ☐
- 4.3 Team Adaptability
  - 4.3.1 Error Correction ☐
  - 4.3.2 Monitoring ☐
  - 4.3.3 Backing-Up ☐
- 4.4 Planning
  - 4.4.1 Allocation of Resources ☑
    - Personnel ☑
    - Time ☑
    - Material ☑
    - Energy ☑
- 4.5 Coordination
  - Interdependence ☑
  - Team structure ☑
  - Resource allocation ☑
  - Communication ☑
  - Mental Models ☑
- 4.6 Team Climate
  - Morale ☐
  - Motivation ☐
  - Trust ☐
  - Cohesion ☐
  - Collective Efficacy ☐

5 Measures

- 5.1 Outcome
  - Computer ☑
- 5.2 Process
  - Self-Report ☐
  - Observer ☐
- 5.3 Level of Analysis
  - 5.3.1 Individual ☐
  - 5.3.2 Team ☐
  - Collective vs. Holistic ☐

Discussion/Observations

NeoCITIES is an interactive computer program designed to display information pertaining to events and occurrences in a virtual city space. The teams in the simulation represent three separate services (e.g., Police, Fire/EMS, and Hazmat) in which they must assess situations, interact and communicate according to their inter-team and intra-team roles, allocate resources in a timely manner, and make decisions within the context of emergency crisis management. Once NeoCITIES development has been completed, the simulation will be used as an experimental task to measure the impact of hidden knowledge profiles on teamwork and decision-making in the distributed team context.

Source: HFES 2005 Conference Proceedings, "The NEOCITIES Simulation: Understanding the design and experimental methodology used to develop a team emergency management simulation," McNEESE, BAINS, P., BREWER, I., BROWN, C., CONNORS, E.S., JEFFERSON JR., T., JONES, R.E.T., TERRELL, I., 2005.

Platform Name: One Semi-Automated Forces (OneSAF)
Reference Number: 7
Organization: U.S. Army
Relevance: Highly Relevant
Primary Purpose: Training

Customized Workstations	☑	Ad Hoc:	Capable
Communication Channels	☑	Interdisciplinary:	Yes
Customized Scenarios	☑	Interagency:	No
Platform Type:	Constructive and Virtual	Joint:	Yes
Fidelity:	Variable	Distributed:	Yes
Team Size:	Scaleable	Teams of Teams:	Yes
Primary Purpose:	Training	Level of Activity:	Operational/Tactical

Platform Description:
OneSAF, as a PC-based or laptop training system, will ultimately be fielded to every battalion in the Army. It will ultimately be deployed to all active duty brigades and battalions; Army schools, labs and engineering centers; National Guard and Army Reserve units. The system is supposed to simulate specific activities of ground warfare, specifically engagement and maneuver. It will include Command, Control, Communications, Computers and Intelligence (C4I) as well as combat support. Using a detailed terrain database, OneSAF will employ highly realistic representations of the physical environment where soldier movements and behaviors can be reproduced to enhance training value.

Operator/Task Description:
No specific scenarios were identified. ONESAF is the entity level simulation designed to train leaders at the brigade level and below. OneSAF will represent a full range of operations, systems and control processes from the individual up to the battalion level.

1 Team Factors

- 1.1 Team Structure
  - 1.1.1 Leadership
    - Transactional ☑
    - Transformational ☐
- 1.2 Team Composition
  - 1.2.1 Individual Traits
    - 1.2.1.1 Personality
      - Agreeableness ☐
      - Conscientiousness ☐
      - Emotional stability ☐
      - Extraversion ☐
      - Openess ☐
    - 1.2.1.2 Cognative ability
      - General cognative ability ☑
      - Spatial orientation ☑
      - Verbal comprehension ☑
      - Reasoning ability ☑
  - 1.2.2 Team Diversity
    - Heterogenous ☐
    - Homogenous ☐

2 Task Factors

- 2.1 Task Type
  - Additive ☐
  - Conjunctive ☐
  - Disjunctive ☐
  - Discretionary ☐
  - Executive ☐
  - Command ☑
  - Negotiation ☐
  - Commissions ☐
  - Advisory ☐
  - Design ☐
- 2.2 Task Characteristics
  - 2.2.1 Task Complexity
    - Scope ☑
    - Structurability ☑
    - Uncertainty ☐
  - 2.2.2 Workload
    - Physical ☐
    - Cognitive ☑
    - Emotional ☑
    - Time pressure ☑
  - 2.2.3 Task Interdependence ☑

3 Team Intervention

- 3.1 Team Training
  - Cross training ☑
  - Team coordination training ☑
  - Team self-correction ☑
  - Assertiveness training ☐
- 3.2 Team Building ☑
- 3.3 Feedback and Goal Setting ☐

4 Team Processes

- 4.1 Shared Knowledge
  - 4.1.1 Mental Models ☑
  - 4.1.2 Situational Awareness ☑
  - 4.1.3 Transactive memory ☐
- 4.2 Communication
  - 4.2.1 Need
    - Communication Frequency ☑
    - Team Structure ☑
  - 4.2.2 Efficiency
    - Anticipation Ratios ☐
    - Team Structure ☐
  - 4.2.3 Technology ☐
  - 4.2.4 Type
    - Implicit vs. Explicit ☐
    - Heterogen vs. Homogen ☐
- 4.3 Team Adaptability
  - 4.3.1 Error Correction ☐
  - 4.3.2 Monitoring ☐
  - 4.3.3 Backing-Up ☐
- 4.4 Planning
  - 4.4.1 Allocation of Resources ☑
    - Personnel ☑
    - Time ☑
    - Material ☐
    - Energy ☐
- 4.5 Coordination
  - Interdependence ☐
  - Team structure ☑
  - Resource allocation ☑
  - Communication ☑
  - Mental Models ☑
- 4.6 Team Climate
  - Morale ☐
  - Motivation ☐
  - Trust ☐
  - Cohesion ☐
  - Collective Efficacy ☐

5 Measures

- 5.1 Outcome
  - Computer ☑
- 5.2 Process
  - Self-Report ☐
  - Observer ☐
- 5.3 Level of Analysis
  - 5.3.1 Individual ☐
  - 5.3.2 Team ☐
  - Collective vs. Holistic ☐

Discussion/Observations

A key feature of One SAF is the Mission Planning and Rehearsal System (MPARS). This system allow commanders to plan actions that will occur in an area of deployment. Using a terrain database of the area, tactical rehearsals can be run quite effectively. The system is supposed to simulate specific activities of ground warfare, specifically engagement and maneuver. It will include Command, Control, Communications, Computers and Intelligence (C4I) as well as combat support. Using a detailed terrain database, OneSAF will employ highly realistic representations of the physical environment where soldier movements and behaviors can be reproduced to enhance training value.

OneSAF is scheduled to end acceptance testing in late 2005 and begin delivering a system to the first user in early 2006. Units will begin using OneSAF in 2007. Designated deployment sites should have the OneSAF capability by the beginning of fiscal 2008.

This platform is extremely flexible.

Sources: http://www.military-training-technology.com/article.cfm?DocID=209
http://www.onesaf.org/onesaf.html
http://www.saic.com/news/saicmag/2003-summer/simulation.html

Platform Name: Tactical Simulation System - TACSIM
Reference Number: 8
Organization: US Army
Relevance: Highly Relevant
Domain: Army

Customized Workstations	☑	Ad Hoc:	Capable
Communication Channels	☑	Interdisciplinary:	Yes
Customized Scenarios	☑	Interagency:	Yes
Platform Type:	Virtual	Joint:	Yes
Fidelity:	Missing info	Distributed:	Yes
Team Size:	Scaleable	Teams of Teams:	Yes
Primary Purpose:	Training	Level of Activity:	Strategic/Operational /Tactical

Platform Description:
The Tactical Simulation System (TACSIM) is the Army's leading intelligence collection and dissemination model. In near-real time, TACSIM aids in the training of Intelligence Analysts, Collection Managers, and staffs for the design of collection requirements and the analysis of raw intelligence. TACSIM uses interactive computer-based simulation to support intelligence training from MI Battalion through Echelons Above Corps in exercises such as REFORGER, Central Fortress, Ulchi Focus Lens, Team Spirit, Warfighter, and others across Germany, Korea, and the United States.

Operator/Task Description:
No specific scenarios were identified.

1 Team Factors

- 1.1 Team Structure
  - 1.1.1 Leadership
    - Transactional ☐
    - Transformational ☐
  - 1.2 Team Composition
    - 1.2.1 Individual Traits
      - 1.2.1.1 Personality
        - Agreeableness ☐
        - Conscientiousness ☐
        - Emotional stability ☐
        - Extraversion ☐
        - Openness ☐
      - 1.2.1.2 Cognitive ability
        - General cognitive ability ☑
        - Spatial orientation ☑
        - Verbal comprehension ☑
        - Reasoning ability ☐
    - 1.2.2 Team Diversity
      - Heterogeneous ☐
      - Homogenous ☐

2 Task Factors

- 2.1 Task Type
  - Additive ☐
  - Conjunctive ☐
  - Disjunctive ☐
  - Discretionary ☐
  - Executive ☐
  - Command ☑
  - Negotiation ☐
  - Commissions ☐
  - Advisory ☐
  - Design ☐
- 2.2 Task Characteristics
  - 2.2.1 Task Complexity
    - Scope ☐
    - Structurability ☐
    - Uncertainty ☐
  - 2.2.2 Workload
    - Physical ☐
    - Cognitive ☑
    - Emotional ☐
    - Time pressure ☐
  - 2.2.3 Task Interdependence ☐

3 Team Intervention

- 3.1 Team Training
  - Cross training ☐
  - Team coordination training ☐
  - Team self-correction ☐
  - Assertiveness training ☐
- 3.2 Team Building ☐
- 3.3 Feedback and Goal Setting ☐

4 Team Processes

- 4.1 Shared Knowledge
  - 4.1.1 Mental Models ☐
  - 4.1.2 Situational Awareness ☐
  - 4.1.3 Transactive memory ☐
- 4.2 Communication
  - 4.2.1 Need
    - Communication Frequency ☑
    - Team Structure ☐
  - 4.2.2 Efficiency
    - Anticipation Ratios ☐
    - Team Structure ☐
  - 4.2.3 Technology ☐
  - 4.2.4 Type
    - Implicit vs. Explicit ☐
    - Heterogen vs. Homogen ☐
- 4.3 Team Adaptability
  - 4.3.1 Error Correction ☐
  - 4.3.2 Monitoring ☐
  - 4.3.3 Backing-Up ☐
- 4.4 Planning
  - 4.4.1 Allocation of Resources ☐
    - Personnel ☐
    - Time ☐
    - Material ☐
    - Energy ☐
- 4.5 Coordination
  - Interdependence ☐
  - Team structure ☐
  - Resource allocation ☐
  - Communication ☐
  - Mental Models ☐
- 4.6 Team Climate
  - Morale ☐
  - Motivation ☐
  - Trust ☐
  - Cohesion ☐
  - Collective Efficacy ☐

5 Measures

- 5.1 Outcome
  - Computer ☑
- 5.2 Process
  - Self-Report ☐
  - Observer ☐
- 5.3 Level of Analysis
  - 5.3.1 Individual ☐
  - 5.3.2 Team ☑
  - Collective vs. Holistic ☐

Discussion/Observations

TACSIM can be used in two ways. For intelligence training only, TACSIM can be operated in the STAND ALONE mode. This allows intelligence staffs, sections, and units to train their personnel on specific training objectives. However, the most common method for training with TACSIM is in the LINKED mode. In this mode, TACSIM is an intelligence model or driver which is linked to another simulation such as the Army's Corps Battle Simulation (CBS). TACSIM can be linked to other service's models; the Air Force's Air Warfare Simulation (AWSIM), the Navy's Research Evaluation and Systems Analysis (RESA), the Marine's Air-Ground Task Force Tactical Simulation (MTWS) and the Joint Electronic Combat Electronic Warfare Simulation (JECEWSI). This is accomplished through the Aggregate Level Simulation Protocol (ALSP) system.

Many details given were specific to platform software. Not enough information was given about specific scenarios, thus mapping to literature was difficult.

Sources: http://www.peostri.army.mil/PRODUCTS/TACSIM/ and http://www.globalsecurity.org/intell/systems/tacsim.htm

Platform Name: Virtual Warfare Centre (VWC)
Reference Number: 9
Organization: Boeing
Relevance: Highly Relevant
Domain: Command and Control

Customized Workstations	☑	Ad Hoc:	Capable
Communication Channels	☑	Interdisciplinary:	Yes
Customized Scenarios	☑	Interagency:	Yes
Platform Type:	Virtual	Joint:	Yes
Fidelity:	High	Distributed:	Yes
Team Size:	Large	Teams of Teams:	Capable
Primary Purpose:	Training	Level of Activity:	Operational

Platform Description:
State-of-the art customer centre allows military experts to analyze and take part in simulated battle scenarios in order to develop future systems and platforms. The 70,000 square foot facility enables more than 150 operators from all military services to participate in warfare-scenarios in real time at the VWC and through military labs across the country. The VWC virtual battle scenarios are realistic, with thousands of air and ground targets, multiple hostile threats and diverse communication networks introduced, making the experience one of the most complex testing environments outside actual warfare.

Operator/Task Description:
No specific scenarios were identified. The simulation environment enables warfighters to observe and control jet aircraft (F-15, F-18, etc.), AWACS, and Patriot platforms.

1 Team Factors

- 1.1 Team Structure
  - 1.1.1 Leadership
    - Transactional ☑
    - Transformational ☐
- 1.2 Team Composition
  - 1.2.1 Individual Traits
    - 1.2.1.1 Personality
      - Agreeableness ☐
      - Conscientiousness ☐
      - Emotional stability ☐
      - Extraversion ☐
      - Openness ☐
    - 1.2.1.2 Cognitive ability
      - General cognitive ability ☐
      - Spatial orientation ☐
      - Verbal comprehension ☐
      - Reasoning ability ☐
  - 1.2.2 Team Diversity
    - Heterogeneous ☐
    - Homogenous ☐

2 Task Factors

- 2.1 Task Type
  - Additive ☑
  - Conjunctive ☐
  - Disjunctive ☐
  - Discretionary ☑
  - Executive ☐
  - Command ☑
  - Negotiation ☐
  - Commissions ☐
  - Advisory ☐
  - Design ☑
- 2.2 Task Characteristics
  - 2.2.1 Task Complexity
    - Scope ☐
    - Structurability ☐
    - Uncertainty ☑
  - 2.2.2 Workload
    - Physical ☐
    - Cognitive ☑
    - Emotional ☐
    - Time pressure ☐
  - 2.2.3 Task Interdependence ☑

3 Team Intervention

- 3.1 Team Training
  - Cross training ☐
  - Team coordination training ☑
  - Team self-correction ☐
  - Assertiveness training ☐
- 3.2 Team Building ☐
- 3.3 Feedback and Goal Setting ☐

4 Team Processes

- 4.1 Shared Knowledge
  - 4.1.1 Mental Models ☐
  - 4.1.2 Situational Awareness ☑
  - 4.1.3 Transactive memory ☐
- 4.2 Communication
  - 4.2.1 Need
    - Communication Frequency ☐
    - Team Structure ☐
  - 4.2.2 Efficiency
    - Anticipation Ratios ☐
    - Team Structure ☐
  - 4.2.3 Technology ☑
  - 4.2.4 Type
    - Implicit vs. Explicit ☐
    - Heterogen vs. Homogen ☐
- 4.3 Team Adaptability
  - 4.3.1 Error Correction ☐
  - 4.3.2 Monitoring ☐
  - 4.3.3 Backing-Up ☐
- 4.4 Planning
  - 4.4.1 Allocation of Resources ☐
    - Personnel ☐
    - Time ☐
    - Material ☐
    - Energy ☐
- 4.5 Coordination
  - Interdependence ☐
  - Team structure ☐
  - Resource allocation ☐
  - Communication ☑
  - Mental Models ☐
- 4.6 Team Climate
  - Morale ☐
  - Motivation ☐
  - Trust ☐
  - Cohesion ☐
  - Collective Efficacy ☐

5 Measures

- 5.1 Outcome
  - Computer ☑
- 5.2 Process
  - Self-Report ☐
  - Observer ☑
- 5.3 Level of Analysis
  - 5.3.1 Individual ☐
  - 5.3.2 Team ☐
  - Collective vs. Holistic ☐

Discussion/Observations
The Virtual Warfare Centre (VWC) is a large collaborative, immersive development environment designed for the design and evaluation of merging Operational concepts such as net-centric operations (NCO). Experiments are conducted to evaluate the impact on system-of-systems and individual systems. The VWC has a designated "War Room" dedicated to monitoring test execution, control of simulations, and visual displays that enable analysts and decision makers to witness and understand emerging events during the simulation. Reconfigurable crew stations enable the centre to incorporate data from other simulations into the test environment. The controls for displays are based on those deployed in the field, but future systems can be generated using Boeing's "Reconfigurable Operator Control and Interface Station" (ROCIS) software.

Sources: http://www.boeing.com/news/releases/2005/q2/nr_050509t.html and http://www.boeing.com/phantom/msa/pw_msa.htm

Platform Name: ADMS
Reference Number: 10
Organization: Environmental Tectonics Corporation (ETC)
Relevance: Relevant
Domain: Emergency Services

Customized Workstations	☑	Ad Hoc:	No
Communication Channels	☑	Interdisciplinary:	Yes
Customized Scenarios	☑	Interagency:	Yes
Platform Type:	Virtual	Joint:	No
Fidelity:	High	Distributed:	Yes
Team Size:	Medium	Teams of Teams:	Missing info
Primary Purpose:	Training	Level of Activity:	Operational/Tactical

Platform Description:
The Advanced Disaster Management Simulator (ADMS™) is an interactive virtual reality-based team training system that provides emergency responders an opportunity to develop skills in emergency response. ADMS simultaneously trains incident commanders and team leaders in disaster management skills, and allows trainees to rehearse and retain the four C's of disaster management: Command, Control Coordination and Communication. ADMS simulates emergency incidents such as aircraft accidents, terrorist acts, Weapons of Mass Destruction, hazardous material spills, airfield incursions, multi-vehicle road accidents, fires and natural disasters for the purposes of planning, training, testing and validating.

Operator/Task Description:
ADMS can facilitate the following types of training:
Incident Command Training, Preparedness Validation, Resource Management, Multi-Agency Coordination Training, Facility & Vehicle, Familiarization, Aircraft Rescue Firefighting, Natural, Terrorist & Hazmat Threats. ADMS is capable of presenting an infinite number of differing scenarios and threats using the Scenario Generator.

1 Team Factors

- 1.1 Team Structure
  - 1.1.1 Leadership
    - Transactional ☐
    - Transformational ☐
- 1.2 Team Composition
  - 1.2.1 Individual Traits
    - 1.2.1.1 Personality
      - Agreeableness ☐
      - Conscientiousness ☐
      - Emotional stability ☐
      - Extraversion ☐
      - Openness ☐
    - 1.2.1.2 Cognitive ability
      - General cognitive ability ☑
      - Spatial orientation ☐
      - Verbal comprehension ☑
      - Reasoning ability ☐
  - 1.2.2 Team Diversity
    - Heterogeneous ☑
    - Homogenous ☑

2 Task Factors

- 2.1 Task Type
  - Additive ☐
  - Conjunctive ☐
  - Disjunctive ☐
  - Discretionary ☐
  - Executive ☐
  - Command ☑
  - Negotiation ☐
  - Commissions ☐
  - Advisory ☐
  - Design ☐
- 2.2 Task Characteristics
  - 2.2.1 Task Complexity
    - Scope ☐
    - Structurability ☐
    - Uncertainty ☐
  - 2.2.2 Workload
    - Physical ☐
    - Cognitive ☐
    - Emotional ☐
    - Time pressure ☐
  - 2.2.3 Task Interdependence ☐

3 Team Intervention

- 3.1 Team Training
  - Cross training ☐
  - Team coordination training ☑
  - Team self-correction ☐
  - Assertiveness training ☐
- 3.2 Team Building ☐
- 3.3 Feedback and Goal Setting ☐

4 Team Processes

- 4.1 Shared Knowledge
  - 4.1.1 Mental Models ☐
  - 4.1.2 Situational Awareness ☐
  - 4.1.3 Transactive memory ☐
- 4.2 Communication
  - 4.2.1 Need
    - Communication Frequency ☑
    - Team Structure ☐
  - 4.2.2 Efficiency
    - Anticipation Ratios ☐
    - Team Structure ☐
  - 4.2.3 Technology ☐
  - 4.2.4 Type
    - Implicit vs. Explicit ☐
    - Heterogen vs. Homogen ☐
- 4.3 Team Adaptability
  - 4.3.1 Error Correction ☐
  - 4.3.2 Monitoring ☐
  - 4.3.3 Backing-Up ☐
- 4.4 Planning
  - 4.4.1 Allocation of Resources ☐
    - Personnel ☐
    - Time ☐
    - Material ☐
    - Energy ☐
- 4.5 Coordination
  - Interdependence ☐
  - Team structure ☐
  - Resource allocation ☑
  - Communication ☑
  - Mental Models ☑
- 4.6 Team Climate
  - Morale ☐
  - Motivation ☐
  - Trust ☐
  - Cohesion ☐
  - Collective Efficacy ☐

5 Measures

- 5.1 Outcome
  - Computer ☑
- 5.2 Process
  - Self-Report ☐
  - Observer ☐
- 5.3 Level of Analysis
  - 5.3.1 Individual ☐
  - 5.3.2 Team ☐
  - Collective vs. Holistic ☐

Discussion/Observations
Configuration: A typical ADMS system includes one Incident Command Station and four Team Stations. Environmental Tectonics Corporation (ETC) works with the customers' subject matter experts to develop a customized training curriculum and deliver training at their facility. Communication is done through radio. ADMS can be installed with a 180-degree surround view projection screen or a simple flat screen for the Incident Command Station. Team stations can be setup within canopied hoods, obstructing sharing of extraneous information between stations and forcing realistic radio communciation.
Interacgency: ADMS can be delivered as a portable system which packs into 3 travel cases. This laptop-based system is ideal for training at large facilities or municipalities for sharing among multiple agencies.
Outcome: OASIS is a comprehensive scoring and record keeping system which maintains student data including time and date of training, modules completed and all scores.

Source: http://www.admstraining.com/

Platform Name: Air Defence Synthetic Environment (ADSE)
Reference Number: 11
Organization: UK DAES MOD SIM
Relevance: Relevant
Domain: Air

Customized Workstations	☐	Ad Hoc:	No
Communication Channels	☑	Interdisciplinary:	Yes
Customized Scenarios	☑	Interagency:	No
Platform Type:	Virtual	Joint:	Yes
Fidelity:	Missing Info	Distributed:	Yes
Team Size:	Missing Info	Teams of Teams:	No
Primary Purpose:	Other	Level of Activity:	Operational/Tactical

Platform Description:
The primary goal of ADSE was the development of a validated set of networked simulation assets representing current and future ground based Air Defence (AD) systems and associated environment.

Operator/Task Description:
No specific scenarios were identified, as platform is still in development. ADSE alllows for observation of the effectiveness of C3I systems in realistically complex and interactive scenarios.

1 Team Factors

- 1.1 Team Structure
  - 1.1.1 Leadership
    - Transactional ☐
    - Transformational ☐
- 1.2 Team Composition
  - 1.2.1 Individual Traits
    - 1.2.1.1 Personality
      - Agreeableness ☐
      - Conscientiousness ☐
      - Emotional stability ☐
      - Extraversion ☐
      - Openess ☐
    - 1.2.1.2 Cognative ability
      - General cognative ability ☐
      - Spatial orientation ☐
      - Verbal comprehension ☐
      - Reasoning ability ☐
  - 1.2.2 Team Diversity
    - Heterogenous ☐
    - Homogenous ☐

2 Task Factors

- 2.1 Task Type
  - Additive ☐
  - Conjunctive ☐
  - Disjunctive ☐
  - Discretionary ☐
  - Executive ☐
  - Command ☑
  - Negotiation ☐
  - Commissions ☐
  - Advisory ☐
  - Design ☐
- 2.2 Task Characteristics
  - 2.2.1 Task Complexity
    - Scope ☐
    - Structurability ☐
    - Uncertainty ☐
  - 2.2.2 Workload
    - Physical ☑
    - Cognitive ☑
    - Emotional ☐
    - Time pressure ☐
  - 2.2.3 Task Interdependence ☐

3 Team Intervention

- 3.1 Team Training
  - Cross training ☐
  - Team coordination training ☐
  - Team self-correction ☐
  - Assertiveness training ☐
- 3.2 Team Building ☐
- 3.3 Feedback and Goal Setting ☐

4 Team Processes

- 4.1 Shared Knowledge
  - 4.1.1 Mental Models ☐
  - 4.1.2 Situational Awareness ☑
  - 4.1.3 Transactive memory ☐
- 4.2 Communication
  - 4.2.1 Need
    - Communication Frequency ☐
    - Team Structure ☐
  - 4.2.2 Efficiency
    - Anticipation Ratios ☐
    - Team Structure ☐
  - 4.2.3 Technology ☐
  - 4.2.4 Type
    - Implicit vs. Explicit ☐
    - Heterogen vs. Homogen ☐
- 4.3 Team Adaptability
  - 4.3.1 Error Correction ☐
  - 4.3.2 Monitoring ☐
  - 4.3.3 Backing-Up ☐
- 4.4 Planning
  - 4.4.1 Allocation of Resources ☐
    - Personnel ☐
    - Time ☐
    - Material ☐
    - Energy ☐
- 4.5 Coordination
  - Interdependence ☐
  - Team structure ☐
  - Resource allocation ☐
  - Communication ☐
  - Mental Models ☐
- 4.6 Team Climate
  - Morale ☐
  - Motivation ☐
  - Trust ☐
  - Cohesion ☐
  - Collective Efficacy ☐

5 Measures

- 5.1 Outcome
  - Computer ☐
- 5.2 Process
  - Self-Report ☐
  - Observer ☑
- 5.3 Level of Analysis
  - 5.3.1 Individual ☐
  - 5.3.2 Team ☐
  - Collective vs. Holistic ☐

Discussion/Observations

Distributed: One of the primary goals of the programme was to ensure that, where possible, the owners of the AD real systems and associated simulation assets be responsible for their development, validation and support at their home sites . This inevitably resulted in the requirement to create a Wide Area Network (WAN) interconnecting many sites across the UK.

This platform was rated only as relevant because it is still in its development stages. There is also not a major focus on teams.

Source: http://www.semb.co.uk/application/ADSE.htm

Platform Name: Aviation Research and Training Tools (ARTT)
Reference Number: 12
Organization: Adecel Technologies, Australian Department of
Relevance: Relevant
Domain: Air Traffic Control

Customized Workstations	☐	Ad Hoc:	Capable
Communication Channels	☑	Interdisciplinary:	Yes
Customized Scenarios	☑	Interagency:	No
Platform Type:	Virtual	Joint:	No
Fidelity:	High	Distributed:	Yes
Team Size:	Medium	Teams of Teams:	Yes
Primary Purpose:	Training	Level of Activity:	Operational

Platform Description:
ARTT has been designed from the ground up to be a family of integrated products. ARTT Tower, Radar, Driver and Coms may be installed at a single computer or multiple computers may be utilized to provide a network of integrated simulators in a cooperative scenario configuration.

Operator/Task Description:
No specific scenarios were identified. Tasks in the simulation suite include airport ground crew driver, air traffic controller, pilot, and control tower.

1 Team Factors

- 1.1 Team Structure
  - 1.1.1 Leadership
    - Transactional ☑
    - Transformational ☐
- 1.2 Team Composition
  - 1.2.1 Individual Traits
    - 1.2.1.1 Personality
      - Agreeableness ☐
      - Conscientiousness ☑
      - Emotional stability ☑
      - Extraversion ☐
      - Openness ☐
    - 1.2.1.2 Cognitive ability
      - General cognitive ability ☑
      - Spatial orientation ☑
      - Verbal comprehension ☑
      - Reasoning ability ☑
  - 1.2.2 Team Diversity
    - Heterogeneous ☑
    - Homogenous ☐

2 Task Factors

- 2.1 Task Type
  - Additive ☐
  - Conjunctive ☑
  - Disjunctive ☐
  - Discretionary ☐
  - Executive ☐
  - Command ☑
  - Negotiation ☑
  - Commissions ☐
  - Advisory ☐
  - Design ☐
- 2.2 Task Characteristics
  - 2.2.1 Task Complexity
    - Scope ☑
    - Structurability ☑
    - Uncertainty ☐
  - 2.2.2 Workload
    - Physical ☐
    - Cognitive ☑
    - Emotional ☐
    - Time pressure ☑
  - 2.2.3 Task Interdependence ☑

3 Team Intervention

- 3.1 Team Training
  - Cross training ☐
  - Team coordination training ☑
  - Team self-correction ☐
  - Assertiveness training ☐
- 3.2 Team Building ☐
- 3.3 Feedback and Goal Setting ☐

4 Team Processes

- 4.1 Shared Knowledge
  - 4.1.1 Mental Models ☑
  - 4.1.2 Situational Awareness ☑
  - 4.1.3 Transactive memory ☑
- 4.2 Communication
  - 4.2.1 Need
    - Communication Frequency ☑
    - Team Structure ☐
  - 4.2.2 Efficiency
    - Anticipation Ratios ☐
    - Team Structure ☐
  - 4.2.3 Technology ☑
  - 4.2.4 Type
    - Implicit vs. Explicit ☑
    - Heterogen vs. Homogen ☐
- 4.3 Team Adaptability
  - 4.3.1 Error Correction ☑
  - 4.3.2 Monitoring ☑
  - 4.3.3 Backing-Up ☑
- 4.4 Planning
  - 4.4.1 Allocation of Resources ☑
    - Personnel ☑
    - Time ☑
    - Material ☐
    - Energy ☐
- 4.5 Coordination
  - Interdependence ☑
  - Team structure ☑
  - Resource allocation ☑
  - Communication ☑
  - Mental Models ☐
- 4.6 Team Climate
  - Morale ☐
  - Motivation ☐
  - Trust ☐
  - Cohesion ☐
  - Collective Efficacy ☑

5 Measures

- 5.1 Outcome
  - Computer ☑
- 5.2 Process
  - Self-Report ☐
  - Observer ☐
- 5.3 Level of Analysis
  - 5.3.1 Individual ☑
  - 5.3.2 Team ☑
  - Collective vs. Holistic ☐

Discussion/Observations
Transactional leadership is carried out by air traffic controllers.

Source: http://www.defence.gov.au/teamaustralia/index8a4d.html and http://www.adacel.com/prodserv/downloads/ARTT.pdf and http://www.adacel.com/prodserv/artt.htm

Platform Name: Arizona State University, Cognitive Engineering Research on Team Tasks (CERTT)
Reference Number: 13
Organization: Arizona State University
Relevance: Relevant
Domain: Command and Control

Customized Workstations	☑	Ad Hoc:	No
Communication Channels	☑	Interdisciplinary:	Yes
Customized Scenarios	☑	Interagency:	No
Platform Type:	Virtual	Joint:	No
Fidelity:	High	Distributed:	Capable
Team Size:	Small	Teams of Teams:	No
Primary Purpose:	Team Experiments	Level of Activity:	Operational

Platform Description:
CERTT's mission is to understand and measure team cognition in socio-technical systems. Their simulation of a three-person Uninhabited Air Vehicle (UAV) ground control task provides a context in which to study socio-technical systems.

Operator/Task Description:
Team of 3 members, each have a distinct role. (1) AVO (Air Vehicle Operator)- controls airspeed, altitude, and heading; monitors UAV systems (2) PLO (Payload Operator)- Adjusts camera settings to take target photos; monitors camera equipment (4) DEMPC (Data Exploitation, Mission Planning and Communications Operator)- Oversees the mission; plans a route under various constraints; reports locations and restrictions.

1 Team Factors

- 1.1 Team Structure
  - 1.1.1 Leadership
    - Transactional ☐
    - Transformational ☐
- 1.2 Team Composition
  - 1.2.1 Individual Traits
    - 1.2.1.1 Personality
      - Agreeableness ☐
      - Conscientiousness ☐
      - Emotional stability ☐
      - Extraversion ☐
      - Openness ☐
    - 1.2.1.2 Cognitive ability
      - General cognitive ability ☑
      - Spatial orientation ☑
      - Verbal comprehension ☐
      - Reasoning ability ☐
  - 1.2.2 Team Diversity
    - Heterogeneous ☑
    - Homogenous ☑

2 Task Factors

- 2.1 Task Type
  - Additive ☐
  - Conjunctive ☐
  - Disjunctive ☐
  - Discretionary ☐
  - Executive ☐
  - Command ☑
  - Negotiation ☐
  - Commissions ☐
  - Advisory ☐
  - Design ☐
- 2.2 Task Characteristics
  - 2.2.1 Task Complexity
    - Scope ☐
    - Structurability ☐
    - Uncertainty ☐
  - 2.2.2 Workload
    - Physical ☐
    - Cognitive ☑
    - Emotional ☐
    - Time pressure ☐
  - 2.2.3 Task Interdependence ☐

3 Team Intervention

- 3.1 Team Training
  - Cross training ☐
  - Team coordination training ☐
  - Team self-correction ☐
  - Assertiveness training ☐
- 3.2 Team Building ☐
- 3.3 Feedback and Goal Setting ☐

4 Team Processes

- 4.1 Shared Knowledge
  - 4.1.1 Mental Models ☑
  - 4.1.2 Situational Awareness ☑
  - 4.1.3 Transactive memory ☐
- 4.2 Communication
  - 4.2.1 Need
    - Communication Frequency ☑
    - Team Structure ☑
  - 4.2.2 Efficiency
    - Anticipation Ratios ☐
    - Team Structure ☐
  - 4.2.3 Technology ☐
  - 4.2.4 Type
    - Implicit vs. Explicit ☐
    - Heterogen vs. Homogen ☐
- 4.3 Team Adaptability
  - 4.3.1 Error Correction ☐
  - 4.3.2 Monitoring ☐
  - 4.3.3 Backing-Up ☐
- 4.4 Planning
  - 4.4.1 Allocation of Resources ☐
    - Personnel ☐
    - Time ☐
    - Material ☐
    - Energy ☐
- 4.5 Coordination
  - Interdependence ☐
  - Team structure ☐
  - Resource allocation ☐
  - Communication ☐
  - Mental Models ☐
- 4.6 Team Climate
  - Morale ☐
  - Motivation ☐
  - Trust ☐
  - Cohesion ☐
  - Collective Efficacy ☐

5 Measures

- 5.1 Outcome
  - Computer ☑
- 5.2 Process
  - Self-Report ☐
  - Observer ☐
- 5.3 Level of Analysis
  - 5.3.1 Individual ☐
  - 5.3.2 Team ☑
  - Collective vs. Holistic ☐

Discussion/Observations

Data has been collected in the context of the UAV testbed in 6 experiments to explore the impact of workload, knowledge sharing, geographic distribution, and experience on team performance, process, and cognition. Past experiments have examined:
- The effect of shared vs. non-shared knowledge on performance
- The effects of workload and co-location (co-location vs. distributed) on performance
- For all male teams only, the effects of workload and co-location on performance

Other variables measured include: situation awareness, teamwork knowledge, task work knowledge, team process, leadership, demographics.

Source: http://www.certt.com/

Platform Name: Combined Arms Tactical Trainer (CATT)
Reference Number: 14
Organization: United Kingdom
Relevance: Relevant
Domain: Command and Control

Customized Workstations	☐	Ad Hoc:	No
Communication Channels	☑	Interdisciplinary:	Yes
Customized Scenarios	☑	Interagency:	No
Platform Type:	Virtual	Joint:	Yes
Fidelity:	High	Distributed:	Yes
Team Size:	Large	Teams of Teams:	Yes
Primary Purpose:	Training	Level of Activity:	Tactical

Platform Description:
CATT is the largest and most sophisticated virtual training facility in the world and because of this has gained a listing in the, "Guinness Book of Records". The simulators are housed in a building the size of two football pitches in Warminster which, in turn, is able to be linked in real-time to a sister facility in Germany. The CATT system enables crews to view a realistic computer-generated world through armoured vehicle periscopes and then fight a battle against a 'virtual foe', also generated by computer. Commanders plan and view the exercise from Battlegroup Headquarters simulators. To make the exercise as effective as possible the system has been made extremely realistic. For example, engines overheat if left idle for too long, repairs are needed if vehicles are damaged and supplies have to be brought up if the battlegroup is to keep fighting. Mobile Infantry commanders can disembark from an armoured vehicle simulator and then climb into a linked 'infantry' simulator to continue the battle 'on foot', exactly as they would do in a live situation.

Operator/Task Description:
No specific scenarios were identified.

1 Team Factors

- 1.1 Team Structure
  - 1.1.1 Leadership
    - Transactional ☐
    - Transformational ☐
  - 1.2 Team Composition
    - 1.2.1 Individual Traits
      - 1.2.1.1 Personality
        - Agreeableness ☐
        - Conscientiousness ☐
        - Emotional stability ☐
        - Extraversion ☐
        - Openness ☐
      - 1.2.1.2 Cognitive ability
        - General cognitive ability ☐
        - Spatial orientation ☐
        - Verbal comprehension ☐
        - Reasoning ability ☐
      - 1.2.2 Team Diversity
        - Heterogeneous ☐
        - Homogenous ☐

2 Task Factors

- 2.1 Task Type
  - Additive ☐
  - Conjunctive ☐
  - Disjunctive ☐
  - Discretionary ☐
  - Executive ☐
  - Command ☐
  - Negotiation ☐
  - Commissions ☐
  - Advisory ☐
  - Design ☐
- 2.2 Task Characteristics
  - 2.2.1 Task Complexity
    - Scope ☐
    - Structurability ☐
    - Uncertainty ☐
  - 2.2.2 Workload
    - Physical ☑
    - Cognitive ☐
    - Emotional ☐
    - Time pressure ☐
  - 2.2.3 Task Interdependence ☐

3 Team Intervention

- 3.1 Team Training
  - Cross training ☐
  - Team coordination training ☐
  - Team self-correction ☐
  - Assertiveness training ☐
- 3.2 Team Building ☐
- 3.3 Feedback and Goal Setting ☐

4 Team Processes

- 4.1 Shared Knowledge
  - 4.1.1 Mental Models ☐
  - 4.1.2 Situational Awareness ☐
  - 4.1.3 Transactive memory ☐
- 4.2 Communication
  - 4.2.1 Need
    - Communication Frequency ☐
    - Team Structure ☐
  - 4.2.2 Efficiency
    - Anticipation Ratios ☐
    - Team Structure ☐
  - 4.2.3 Technology ☐
  - 4.2.4 Type
    - Implicit vs. Explicit ☐
    - Heterogen vs. Homogen ☐
- 4.3 Team Adaptability
  - 4.3.1 Error Correction ☐
  - 4.3.2 Monitoring ☐
  - 4.3.3 Backing-Up ☐
- 4.4 Planning
  - 4.4.1 Allocation of Resources ☐
    - Personnel ☑
    - Time ☑
    - Material ☐
    - Energy ☐
- 4.5 Coordination
  - Interdependence ☐
  - Team structure ☐
  - Resource allocation ☐
  - Communication ☐
  - Mental Models ☐
- 4.6 Team Climate
  - Morale ☐
  - Motivation ☐
  - Trust ☐
  - Cohesion ☐
  - Collective Efficacy ☐

5 Measures

- 5.1 Outcome
  - Computer ☐
- 5.2 Process
  - Self-Report ☐
  - Observer ☐
- 5.3 Level of Analysis
  - 5.3.1 Individual ☐
  - 5.3.2 Team ☐
  - Collective vs. Holistic ☐

Discussion/Observations
The benefits of the CATT system are numerous and include the following:

- The latest technology to keep front-line troops trained to the required high levels of operational effectiveness, reducing pressure on training land, the defence budget and the environment.
- Complements both army skills training and field training.
- Realistic levels of maneuver and procedural training in an unconstrained virtual battlefield.
- Allows all arms of service (ie. infantry and cavalry etc) to train in the same environment allowing better and more effective preparation for future training in the field.
- Allows unprecedented exercise control.

This platform is mainly used for tactical training. Some planning is involved for commanders to plan the exercises for training.

Source: http://www.mod.uk/dpa/projects/catt.htm

Platform Name: Corps Battle Simulation (CBS)
Reference Number: 15
Organization: US Army PEO STRI (Program Executive Office for Simulation, Training, & Instrumentation)
Relevance: Relevant
Domain: Army, National Guard, and US Army Reserve

Customized Workstations	☐	Ad Hoc:	Capable
Communication Channels	☑	Interdisciplinary:	Yes
Customized Scenarios	☑	Interagency:	Yes
Platform Type:	Virtual	Joint:	Yes
Fidelity:	Missing Info	Distributed:	Capable
Team Size:	Scaleable	Teams of Teams:	No
Primary Purpose:	Training	Level of Activity:	Tactical

Platform Description:
CBS is a geographically and functionally distributed air/land warfare simulation that drives the U.S. Army Battle Command Training Program's (BCTP) War Fighter Exercises as well as Corps and Division command post training exercises for the active Army, National Guard, and the US Army Reserve. The CBS simulation also serves as the Land Warfare component of various Joint Training Exercises as a member of the Joint Training Confederation (JTC). CBS provides training stimuli for all ground forces staff elements from Brigade to Corps including combat, combat support, combat service support, and fixed and rotary wing air operations.

Operator/Task Description:
No specific scenarios were identified.

1 Team Factors

- 1.1 Team Structure
  - 1.1.1 Leadership
    - Transactional ☐
    - Transformational ☐
- 1.2 Team Composition
  - 1.2.1 Individual Traits
    - 1.2.1.1 Personality
      - Agreeableness ☐
      - Conscientiousness ☐
      - Emotional stability ☐
      - Extraversion ☐
      - Openness ☐
    - 1.2.1.2 Cognitive ability
      - General cognitive ability ☐
      - Spatial orientation ☐
      - Verbal comprehension ☐
      - Reasoning ability ☐
  - 1.2.2 Team Diversity
    - Heterogeneous ☐
    - Homogenous ☐

2 Task Factors

- 2.1 Task Type
  - Additive ☐
  - Conjunctive ☐
  - Disjunctive ☐
  - Discretionary ☐
  - Executive ☐
  - Command ☑
  - Negotiation ☐
  - Commissions ☐
  - Advisory ☐
  - Design ☐
- 2.2 Task Characteristics
  - 2.2.1 Task Complexity
    - Scope ☐
    - Structurability ☐
    - Uncertainty ☐
  - 2.2.2 Workload
    - Physical ☑
    - Cognitive ☐
    - Emotional ☐
    - Time pressure ☐
  - 2.2.3 Task Interdependence ☐

3 Team Intervention

- 3.1 Team Training
  - Cross training ☐
  - Team coordination training ☐
  - Team self-correction ☐
  - Assertiveness training ☐
- 3.2 Team Building ☐
- 3.3 Feedback and Goal Setting ☐

4 Team Processes

- 4.1 Shared Knowledge
  - 4.1.1 Mental Models ☐
  - 4.1.2 Situational Awareness ☐
  - 4.1.3 Transactive memory ☐
- 4.2 Communication
  - 4.2.1 Need
    - Communication Frequency ☐
    - Team Structure ☐
  - 4.2.2 Efficiency
    - Anticipation Ratios ☐
    - Team Structure ☐
  - 4.2.3 Technology ☐
  - 4.2.4 Type
    - Implicit vs. Explicit ☐
    - Heterogen vs. Homogen ☐
- 4.3 Team Adaptability
  - 4.3.1 Error Correction ☐
  - 4.3.2 Monitoring ☐
  - 4.3.3 Backing-Up ☐
- 4.4 Planning
  - 4.4.1 Allocation of Resources ☐
    - Personnel ☐
    - Time ☐
    - Material ☐
    - Energy ☐
- 4.5 Coordination
  - Interdependence ☐
  - Team structure ☐
  - Resource allocation ☐
  - Communication ☐
  - Mental Models ☐
- 4.6 Team Climate
  - Morale ☐
  - Motivation ☐
  - Trust ☐
  - Cohesion ☐
  - Collective Efficacy ☐

5 Measures

- 5.1 Outcome
  - Computer ☑
- 5.2 Process
  - Self-Report ☐
  - Observer ☐
- 5.3 Level of Analysis
  - 5.3.1 Individual ☐
  - 5.3.2 Team ☐
  - Collective vs. Holistic ☐

Discussion/Observations
The CBS simulation also serves as the Land Warfare component of various Joint Training Exercises as a member of the Joint Training Confederation (JTC). CBS provides training stimuli for all ground forces staff elements from Brigade to Corps including combat, combat support, combat service support, and fixed and rotary wing air operations. All Battle Operating Systems are represented: Maneuver, Command & Control, Fire Support, Air Defense, Combat Service Support, Mobility / Countermobility / Survivability, Intelligence, as well as fixed and rotary wing air operations, NBC operations including Smoke and Chemical Recon and Decon, Special Operations, Civil Affairs and PsyOp.

The focus of this simulation is training, in primarily tactical environments. It models units from section and squad trhough divison level. It provides the Commander and Staff with information to stimulate the decision making process.

Sources: http://www.peostri.army.mil/PRODUCTS/CBS/ and http://www.msrr.army.mil/index.cfm?RID=MNS_A_1000787

Platform Name: GESI - Gefechts Simulationssystem
Reference Number: 16
Organization: CAE
Relevance: Relevant
Domain: Command and Control

Customized Workstations	☐	Ad Hoc:	Capable
Communication Channels	☑	Interdisciplinary:	Yes
Customized Scenarios	☑	Interagency:	No
Platform Type:	Virtual	Joint:	Yes
Fidelity:	High	Distributed:	Yes
Team Size:	Medium	Teams of Teams:	Yes
Primary Purpose:	Training	Level of Activity:	Tactical

Platform Description:
GESI Command and Staff Training System is based on a constructive simulation model and provides combined arms combat and operations other than war (OOTW) exercises from company up to division levels. The commanders determine the course of the simulation exercise by the decisions they make and are immediately confronted with the results of their actions.

Operator/Task Description:
No specific scenarios were identified.

1 Team Factors
- 1.1 Team Structure
  - 1.1.1 Leadership
    - Transactional ☐
    - Transformational ☐
- 1.2 Team Composition
  - 1.2.1 Individual Traits
    - 1.2.1.1 Personality
      - Agreeableness ☐
      - Conscientiousness ☐
      - Emotional stability ☐
      - Extraversion ☐
      - Openness ☐
    - 1.2.1.2 Cognitive ability
      - General cognitive ability ☐
      - Spatial orientation ☐
      - Verbal comprehension ☐
      - Reasoning ability ☐
  - 1.2.2 Team Diversity
    - Heterogeneous ☐
    - Homogenous ☐

2 Task Factors
- 2.1 Task Type
  - Additive ☐
  - Conjunctive ☐
  - Disjunctive ☐
  - Discretionary ☐
  - Executive ☐
  - Command ☐
  - Negotiation ☐
  - Commissions ☐
  - Advisory ☐
  - Design ☐
- 2.2 Task Characteristics
  - 2.2.1 Task Complexity
    - Scope ☐
    - Structurability ☐
    - Uncertainty ☐
  - 2.2.2 Workload
    - Physical ☑
    - Cognitive ☐
    - Emotional ☐
    - Time pressure ☐
  - 2.2.3 Task Interdependence ☐

3 Team Intervention
- 3.1 Team Training
  - Cross training ☐
  - Team coordination training ☐
  - Team self-correction ☐
  - Assertiveness training ☐
- 3.2 Team Building ☐
- 3.3 Feedback and Goal Setting ☐

4 Team Processes
- 4.1 Shared Knowledge
  - 4.1.1 Mental Models ☐
  - 4.1.2 Situational Awareness ☐
  - 4.1.3 Transactive memory ☐
- 4.2 Communication
  - 4.2.1 Need
    - Communication Frequency ☐
    - Team Structure ☑
  - 4.2.2 Efficiency
    - Anticipation Ratios ☐
    - Team Structure ☐
  - 4.2.3 Technology
    - 4.2.4 Type
      - Implicit vs. Explicit ☐
      - Heterogen vs. Homogen ☐
- 4.3 Team Adaptability
  - 4.3.1 Error Correction ☐
  - 4.3.2 Monitoring ☐
  - 4.3.3 Backing-Up ☐
- 4.4 Planning
  - 4.4.1 Allocation of Resources ☐
    - Personnel ☐
    - Time ☐
    - Material ☐
    - Energy ☐
- 4.5 Coordination
  - Interdependence ☐
  - Team structure ☐
  - Resource allocation ☐
  - Communication ☐
  - Mental Models ☐
- 4.6 Team Climate
  - Morale ☐
  - Motivation ☐
  - Trust ☐
  - Cohesion ☐
  - Collective Efficacy ☐

5 Measures
- 5.1 Outcome
  - Computer ☑
- 5.2 Process
  - Self-Report ☐
  - Observer ☐
- 5.3 Level of Analysis
  - 5.3.1 Individual ☐
  - 5.3.2 Team ☐
  - Collective vs. Holistic ☐

Discussion/Observations
The GESI system is used not only for traditional Combined Arms Combat Training, but also as a tool for training commanders for OOTW missions as well as for Joint and Coalition exercises. Since the terrain of any part of the world can be modelled in GESI, it is possible to perform pre-deployment training for out-of-area missions in the most realistic way, without having to leave the country. Recent developments allow the use of GESI in distributed exercises using regular telephone lines or the Internet as the communication infrastructure.

GESI is currently in use in seven countries in Europe. Germany, Austria, Italy, Norway, Finland, Ireland and Lithuania are all using GESI as a training tool for Army Battalion and Brigade Commanders. In Norway, GESI is also in use as a classroom trainer at the Military Academy.

Although this platform met almost all of the 6 criteria, it was only deemed as "relevant" because of it is partly a constructive simulation and it is mainly used in tactical environments.

Source: http://www.cae.com/www2004/Products_and_Services/Military_Simulation_and_Training/Equipment_and_Technology/Land_Training_Systems/GESI/productDetail.shtml

Platform Name: Joint Theatre Level Simulation
Reference Number: 17
Organization: United States Department of Defence
Relevance: Relevant
Domain: Command and Control

Customized Workstations	☑	Ad Hoc:	Capable
Communication Channels	☐	Interdisciplinary:	Yes
Customized Scenarios	☐	Interagency:	No
Platform Type:	Virtual	Joint:	Yes
Fidelity:	Missing Info	Distributed:	Yes
Team Size:	Scaleable	Teams of Teams:	Capable
Primary Purpose:	Training	Level of Activity:	Operational/Tactical

Platform Description:
Joint Theatre Level Simulation (JTLS), an interactive, computer-assisted simulation tool used in joint training programs, focuses on the operational level of war as experienced by the regional combatant commanders and joint task force staffs.

Operator/Task Description:
No specific scenarios were identified. The JTLS models multisided air, ground, and naval combat, with logistical, special operation force (SOF), and intelligence support.

1 Team Factors

- 1.1 Team Structure
  - 1.1.1 Leadership
    - Transactional ☐
    - Transformational ☐
- 1.2 Team Composition
  - 1.2.1 Individual Traits
    - 1.2.1.1 Personality
      - Agreeableness ☐
      - Conscientiousness ☐
      - Emotional stability ☐
      - Extraversion ☐
      - Openess ☐
    - 1.2.1.2 Cognative ability
      - General cognative ability ☐
      - Spatial orientation ☐
      - Verbal comprehension ☐
      - Reasoning ability ☐
  - 1.2.2 Team Diversity
    - Heterogenous ☐
    - Homogenous ☐

2 Task Factors

- 2.1 Task Type
  - Additive ☐
  - Conjunctive ☐
  - Disjunctive ☐
  - Discretionary ☐
  - Executive ☐
  - Command ☑
  - Negotiation ☐
  - Commissions ☐
  - Advisory ☐
  - Design ☐
- 2.2 Task Characteristics
  - 2.2.1 Task Complexity
    - Scope ☐
    - Structurability ☐
    - Uncertainty ☐
  - 2.2.2 Workload
    - Physical ☐
    - Cognitive ☐
    - Emotional ☐
    - Time pressure ☐
  - 2.2.3 Task Interdependence ☐

3 Team Intervention

- 3.1 Team Training
  - Cross training ☐
  - Team coordination training ☑
  - Team self-correction ☐
  - Assertiveness training ☐
- 3.2 Team Building ☐
- 3.3 Feedback and Goal Setting ☐

4 Team Processes

- 4.1 Shared Knowledge
  - 4.1.1 Mental Models ☐
  - 4.1.2 Situational Awareness ☐
  - 4.1.3 Transactive memory ☐
- 4.2 Communication
  - 4.2.1 Need
    - Communication Frequency ☐
    - Team Structure ☐
  - 4.2.2 Efficiency
    - Anticipation Ratios ☐
    - Team Structure ☐
  - 4.2.3 Technology ☐
  - 4.2.4 Type
    - Implicit vs. Explicit ☐
    - Heterogen vs. Homogen ☐
- 4.3 Team Adaptability
  - 4.3.1 Error Correction ☐
  - 4.3.2 Monitoring ☐
  - 4.3.3 Backing-Up ☐
- 4.4 Planning
  - 4.4.1 Allocation of Resources ☑
    - Personnel ☐
    - Time ☐
    - Material ☐
    - Energy ☐
- 4.5 Coordination
  - Interdependence ☐
  - Team structure ☐
  - Resource allocation ☐
  - Communication ☐
  - Mental Models ☐
- 4.6 Team Climate
  - Morale ☐
  - Motivation ☐
  - Trust ☐
  - Cohesion ☐
  - Collective Efficacy ☐

5 Measures

- 5.1 Outcome
  - Computer ☐
- 5.2 Process
  - Self-Report ☐
  - Observer ☐
- 5.3 Level of Analysis
  - 5.3.1 Individual ☐
  - 5.3.2 Team ☐
  - Collective vs. Holistic ☐

Discussion/Observations
JTLS' primary focus is the operational level of war, it employs significant tactical level capabilities using high-resolution units.

Distributed: The simulation supports links to most fielded real-world command and control, communications, computers and intelligence (C4I) systems and other models through customized interfaces. This flexibility provides maximum utility and usability - to include high-level architecture (HLA) applications.

Planners frequently used JTLS as a training support model and for mission planning and rehearsals and it has evolved as an important warfighting training tool. It has undergone continuous functional and system upgrades since that time.

This platform does not have a major focus on teams.

Platform Name: Marine Corps Air Ground Task Force (MAGTF) Marine Tactical Warfare Simulation (MTWS)
Reference Number: 18
Organization: Marine Corps
Relevance: Relevant
Domain: Military General

Customized Workstations	☑	Ad Hoc:	Capable
Communication Channels	☑	Interdisciplinary:	Yes
Customized Scenarios	☑	Interagency:	No
Platform Type:	Constructive and Virtual	Joint:	Yes
Fidelity:	Medium	Distributed:	Capable
Team Size:	Medium	Teams of Teams:	Capable
Primary Purpose:	Other	Level of Activity:	Operational/Tactical

Platform Description:
The Marine Air Ground Task Force (MAGTF) Tactical Warfare Simulation (MTWS) is a computer-assisted exercise support tool designed to support Marine Corps commanders and their staffs. MTWS is used in Command Post Exercises (CPX), in which combat forces, supporting arms, and results of combat are modeled by the system. MTWS can be used to plan tactical operations, evaluate a plan under alternative enemy or environmental conditions, and as an experimental tool to assess decision making.

Operator/Task Description:
No specific scenarios were identified. Capabilities of this platform are listed in "Discussion/Observations".

1 Team Factors
- 1.1 Team Structure
  - 1.1.1 Leadership
    - Transactional ☐
    - Transformational ☐
- 1.2 Team Composition
  - 1.2.1 Individual Traits
    - 1.2.1.1 Personality
      - Agreeableness ☐
      - Conscientiousness ☐
      - Emotional stability ☐
      - Extraversion ☐
      - Openness ☐
    - 1.2.1.2 Cognitive ability
      - General cognitive ability ☐
      - Spatial orientation ☐
      - Verbal comprehension ☐
      - Reasoning ability ☐
  - 1.2.2 Team Diversity
    - Heterogeneous ☐
    - Homogenous ☐

2 Task Factors
- 2.1 Task Type
  - Additive ☐
  - Conjunctive ☐
  - Disjunctive ☐
  - Discretionary ☐
  - Executive ☐
  - Command ☑
  - Negotiation ☐
  - Commissions ☐
  - Advisory ☐
  - Design ☐
- 2.2 Task Characteristics
  - 2.2.1 Task Complexity
    - Scope ☐
    - Structurability ☐
    - Uncertainty ☐
  - 2.2.2 Workload
    - Physical ☑
    - Cognitive ☐
    - Emotional ☐
    - Time pressure ☐
  - 2.2.3 Task Interdependence ☐

3 Team Intervention
- 3.1 Team Training
  - Cross training ☐
  - Team coordination training ☐
  - Team self-correction ☐
  - Assertiveness training ☐
- 3.2 Team Building ☐
- 3.3 Feedback and Goal Setting ☐

4 Team Processes
- 4.1 Shared Knowledge
  - 4.1.1 Mental Models ☐
  - 4.1.2 Situational Awareness ☐
  - 4.1.3 Transactive memory ☐
- 4.2 Communication
  - 4.2.1 Need
    - Communication Frequency ☐
    - Team Structure ☐
  - 4.2.2 Efficiency
    - Anticipation Ratios ☐
    - Team Structure ☐
  - 4.2.3 Technology ☐
  - 4.2.4 Type
    - Implicit vs. Explicit ☐
    - Heterogen vs. Homogen ☐
- 4.3 Team Adaptability
  - 4.3.1 Error Correction ☐
  - 4.3.2 Monitoring ☐
  - 4.3.3 Backing-Up ☐
- 4.4 Planning
  - 4.4.1 Allocation of Resources ☑
    - Personnel ☑
    - Time ☐
    - Material ☐
    - Energy ☐
- 4.5 Coordination
  - Interdependence ☐
  - Team structure ☐
  - Resource allocation ☐
  - Communication ☐
  - Mental Models ☐
- 4.6 Team Climate
  - Morale ☐
  - Motivation ☐
  - Trust ☐
  - Cohesion ☐
  - Collective Efficacy ☐

5 Measures
- 5.1 Outcome
  - Computer ☐
- 5.2 Process
  - Self-Report ☐
  - Observer ☐
- 5.3 Level of Analysis
  - 5.3.1 Individual ☐
  - 5.3.2 Team ☐
  - Collective vs. Holistic ☐

Discussion/Observations
The system is mainly used for tactical purposes. It supports field exercises involving actual combat units, command post exercises involving only command staffs and exercises using a combination of combat units and command staffs. MTWS supports multisided, free play simulation to permit the creation of a wide variety of tactical situations to challenge the command staffs in the decision-making process. The MTWS simulation capabilities offer the full range of MAGTF combat, combat support and combat service support applications, including amphibious operations. Some of the capabilities simulated in MTWS are:
- Ground target detection by visual, sound, sensor and ground radar means
- Air target detection by visual, IR, SLAR and photographic means
- Target destruction by ground engagement, and supporting arms (air, fire support, naval gunfire, cruise missile, etc.)
- Intelligence play from ground and air reconnaissance sources
- Logistic play, to include resupply, repair and medevac

Sources: http://www.globalsecurity.org/military/agency/usmc/magtf.htm ; http://www.manningaffordability.com/s&tweb/PUBS/NAGTF/nagtf-hf.htm ;and http://www.29palms.usmc.mil/dirs/ont/mands/mwts.asp

Platform Name: Tactical Navy Decision Making System - TANDEM
Reference Number: 19
Organization: Navel Systems Training Centre, Orlando
Relevance: Relevant
Domain: Command and Control

Customized Workstations	☑	Ad Hoc:	Yes
Communication Channels	☐	Interdisciplinary:	Yes
Customized Scenarios	☑		
		Interagency:	No
Platform Type:	Virtual	Joint:	Yes
Fidelity:	low	Distributed:	Capable
Team Size:	Small	Teams of Teams:	Yes
Primary Purpose:	Team Experiments	Level of Activity:	Tactical

Platform Description:
TANDEM (1992) was designed to be a more ecologically valid simulation of a command, control, and communication environment; rather than use synthetic work it employs tasks that are closer to the real-life counterpart of a combat information centre. Decision- making skills require information-sharing among one to three participants, as decisions must be made based on provided information regarding unknown contacts. Task characteristics such as interdependence, time pressure, and work load can be examined, and the scenario is reconfigurable. However, TANDEM does not require the integration of new or changing information over time; participants are equipped with the same knowledge set for the duration of the session.

Operator/Task Description:
TANDEM was developed to provide a simplified tactical decision-making environment. In TANDEM, subjects perform a sequence of time critical information gathering and communication tasks to identify targets then decide whether to shoot or clear each target. The task, in essence, is to determine the type and intent of the target, and take appropriate action.

1 Team Factors
- 1.1 Team Structure
  - 1.1.1 Leadership
    - Transactional ☐
    - Transformational ☐
- 1.2 Team Composition
  - 1.2.1 Individual Traits
    - 1.2.1.1 Personality
      - Agreeableness ☐
      - Conscientiousness ☐
      - Emotional stability ☐
      - Extraversion ☐
      - Openness ☐
    - 1.2.1.2 Cognitive ability
      - General cognitive ability ☐
      - Spatial orientation ☐
      - Verbal comprehension ☐
      - Reasoning ability ☐
  - 1.2.2 Team Diversity
    - Heterogeneous ☐
    - Homogenous ☐

2 Task Factors
- 2.1 Task Type
  - Additive ☐
  - Conjunctive ☐
  - Disjunctive ☐
  - Discretionary ☐
  - Executive ☐
  - Command ☐
  - Negotiation ☐
  - Commissions ☐
  - Advisory ☐
  - Design ☐
- 2.2 Task Characteristics
  - 2.2.1 Task Complexity
    - Scope ☐
    - Structurability ☐
    - Uncertainty ☑
  - 2.2.2 Workload
    - Physical ☑
    - Cognitive ☑
    - Emotional ☐
    - Time pressure ☑
  - 2.2.3 Task Interdependence ☑

3 Team Intervention
- 3.1 Team Training
  - Cross training ☐
  - Team coordination training ☐
  - Team self-correction ☐
  - Assertiveness training ☐
- 3.2 Team Building ☐
- 3.3 Feedback and Goal Setting ☐

4 Team Processes
- 4.1 Shared Knowledge
  - 4.1.1 Mental Models ☐
  - 4.1.2 Situational Awareness ☐
  - 4.1.3 Transactive memory ☐
- 4.2 Communication
  - 4.2.1 Need
    - Communication Frequency ☐
    - Team Structure ☐
  - 4.2.2 Efficiency
    - Anticipation Ratios ☐
    - Team Structure ☐
  - 4.2.3 Technology ☑
  - 4.2.4 Type
    - Implicit vs. Explicit ☐
    - Heterogen vs. Homogen ☐
- 4.3 Team Adaptability
  - 4.3.1 Error Correction ☐
  - 4.3.2 Monitoring ☑
  - 4.3.3 Backing-Up ☐
- 4.4 Planning
  - 4.4.1 Allocation of Resources ☐
    - Personnel ☐
    - Time ☐
    - Material ☐
    - Energy ☐
- 4.5 Coordination
  - Interdependence ☐
  - Team structure ☐
  - Resource allocation ☐
  - Communication ☐
  - Mental Models ☐
- 4.6 Team Climate
  - Morale ☐
  - Motivation ☐
  - Trust ☐
  - Cohesion ☐
  - Collective Efficacy ☐

5 Measures
- 5.1 Outcome
  - Computer ☑
- 5.2 Process
  - Self-Report ☐
  - Observer ☐
- 5.3 Level of Analysis
  - 5.3.1 Individual ☐
  - 5.3.2 Team ☑
  - Collective vs. Holistic ☐

Discussion/Observations
One study (Canty & Schwab) found that virtual communication has a strong negative effect on group performance and group efficacy. The goal of another study (Lenox et. al) was to examine the impact of intelligent agents on communication patterns, data gathering strategies, reliance on intelligent agents, and performance.

Numerous performance measures can be collected, including how often and how long each target was "hooked" (i.e. observed) as well as correct/incorrect identification, action choices, total scores, and others.

This platform is similar to the DRDC facility, platform TITAN.

Sources: http://72.14.203.104/search?q=cache:_Z86OSsDtWIJ:usl.sis.pitt.edu/ulab/pubs/HFES99LHLR.pdf+should+we+support+individuals+or+teams&hl=en and Article: Challenges of Virtual Teams: The Complex Effects of Personality and Turnover on Trust, Collective Efficacy, Performance, and Member Retention ; Canty and Schwab, 2001

Platform Name: TITAN (Team and Individual Tactical Assessment Network)
Reference Number: 20
Organization: DRDC Toronto, Team Decision Making and C2 Facility
Relevance: Relevant
Domain: Command and Control

Customized Workstations	☑	Ad Hoc:	Capable
Communication Channels	☑	Interdisciplinary:	Yes
Customized Scenarios	☑		
		Interagency:	No
Platform Type:	Virtual	Joint:	Yes
Fidelity:	Low	Distributed:	Capable
Team Size:	Scaleable	Teams of Teams:	Capable
Primary Purpose:	Decision Making	Level of Activity:	Strategic/Tactical

Platform Description:
T.I.T.A.N. (Team and Individual Tactical Assessment Network) is a low-fidelity defence simulator designed by NTT Systems Inc. (www.ntt.ca) to test the effects of decision support aids on decision-making processes. It is a highly flexible and configurable theory-based simulator. TITAN can be run in both standalone (solo) and networked (team) platforms. The networked platform is played with an all human team or a combined team of human and automated agents. Automated agents are computer-generated players that can be programmed by the experimenter to display specific response patterns (e.g., response bias or error, delayed response). Several features of the simulator interface and task parameters can also be customized by the experimenter to accommodate a specific experimental design or method. Networked TITAN offers the potential for multiple players from different geographic locations to participate in the same TITAN session simultaneously in real time via the Internet.

Operator/Task Description:
A typical networked TITAN experiment employs a hierarchical team with a Leader and three subordinates: Alpha, Bravo, and Charlie. The team members are asked to imagine themselves as officers aboard a naval ship. Their mission is to evaluate the threat posed by the air, surface and subsurface traffic (aka. "contacts") in their ship's vicinity. Their ship and the contacts surrounding it are displayed on the radar screen at each workstation. The team's task begins with the Leader selecting a contact for the subordinates to evaluate. The Leader waits for each subordinate to use the information gathered by the ship's sensors to evaluate the threat level of the contact. Upon reviewing their respective contact information the subordinates each submit a threat assessment to the Leader. Once the Leader receives all three threat assessments (s)he synthesizes the information and submits a final threat assessment on behalf of the team. The Leader is then presented with a confidence question asking him/her to rate how confident (s)he is that the final threat assessment was within 10% percent of the true threat of the contact. Shortly after the Leader submits his/her confidence rating, the team receives visual and numerical feedback on their performance. Once the team finishes reviewing their feedback the Leader selects the next contact to evaluate

1 Team Factors

1.1 Team Structure	
1.1.1 Leadership	
Transactional	☑
Transformational	☐
1.2 Team Composition	
1.2.1 Individual Traits	
1.2.1.1 Personality	
Agreeableness	☐
Conscientiousness	☐
Emotional stability	☐
Extraversion	☐
Openness	☐
1.2.1.2 Cognitive ability	
General cognitive ability	☐
Spatial orientation	☐
Verbal comprehension	☐
Reasoning ability	☐
1.2.2 Team Diversity	
Heterogeneous	☐
Homogenous	☐

2 Task Factors

2.1 Task Type	
Additive	☐
Conjunctive	☐
Disjunctive	☐
Discretionary	☐
Executive	☐
Command	☐
Negotiation	☐
Commissions	☐
Advisory	☐
Design	☐
2.2 Task Characteristics	
2.2.1 Task Complexity	
Scope	☐
Structurability	☐
Uncertainty	☐
2.2.2 Workload	
Physical	☑
Cognitive	☑
Emotional	☐
Time pressure	☑
2.2.3 Task Interdependence	☐

3 Team Intervention

3.1 Team Training	
Cross training	☐
Team coordination training	☐
Team self-correction	☐
Assertiveness training	☐
3.2 Team Building	☐
3.3 Feedback and Goal Setting	☐

4 Team Processes

4.1 Shared Knowledge	
4.1.1 Mental Models	☑
4.1.2 Situational Awareness	☑
4.1.3 Transitive memory	☐
4.2 Communication	
4.2.1 Need	
Communication Frequency	☐
Team Structure	☐
4.2.2 Efficiency	
Anticipation Ratios	☐
Team Structure	☐
4.2.3 Technology	☐
4.2.4 Type	
Implicit vs. Explicit	☐
Heterogen vs. Homogen	☐
4.3 Team Adaptability	
4.3.1 Error Correction	☐
4.3.2 Monitoring	☐
4.3.3 Backing-Up	☐
4.4 Planning	
4.4.1 Allocation of Resources	☐
Personnel	☐
Time	☐
Material	☐
Energy	☐
4.5 Coordination	
Interdependence	☐
Team structure	☐
Resource allocation	☐
Communication	☐
Mental Models	☐
4.6 Team Climate	
Morale	☐
Motivation	☐
Trust	☐
Cohesion	☐
Collective Efficacy	☐

5 Measures

5.1 Outcome	
Computer	☑
5.2 Process	
Self-Report	☐
Observer	☐
5.3 Level of Analysis	
5.3.1 Individual	☑
5.3.2 Team	☑
Collective vs. Holistic	☑

Discussion/Observations
Each contact has 15 characteristics (Speed, Altitude, Signal Strength, Climb Dive, etc.) that are monitored by the ship's sensors. Responsibility for these characteristics is divided evenly between the three subordinate workstations (i.e., Alpha is responsible for 5 characteristics, Bravo is responsible for 5, etc.). The decision matrix is a table that lists contact characteristics and their respective decision criteria for three threat categories: Peaceful, Unknown, and Hostile. Each characteristic has a value (number or word) that meets the criteria of one of the three threat categories. The subordinates' task is to classify each characteristic and judge the threat level of the contact based on the sum of their findings. For example, a contact with 4 Peaceful characteristics and 1 Hostile characteristic would be assessed as peaceful (minimal threat) since the majority of characteristics fall into the Peaceful category.

Some studies using TITAN include the effects of 30 hours of sleep loss and continuous cognitive work on performance in a complex and interactive team decision-making environment and theoretical and empirical issues pertaining to the applicability of fast and frugal heuristics as models for the basic Command and Control (C2) task of threat assessment.

A site visit to this facility was conducted on 15 Dec 05. TITAN is similar to the platform TANDEM. TITAN was rated as only relevant because it's primary focus is on decision making.

Sources: http://www.toronto.drdc-rddc.gc.ca/publications/factsheets/f09_e.html and Titan Introduction, User's Manual, Heather Devine, 1999

Platform Name: Warfigher's Simulation (WARSIM)
Reference Number: 21
Organization: US Army PEO STRI (Program Executive Office for Simulation, Training, & Instrumentation)
Relevance: Relevant
Domain: Military General

Customized Workstations	☐	Ad Hoc:	Yes
Communication Channels	☑	Interdisciplinary:	Yes
Customized Scenarios	☑	Interagency:	Capable
Platform Type:	Constructive and Virtual	Joint:	Yes
Fidelity:	Missing Info	Distributed:	Yes
Team Size:	Scaleable	Teams of Teams:	Yes
Primary Purpose:	Training	Level of Activity:	Tactical

Platform Description:
WARSIM is an aggregate and distributed constructive wargaming simulation designed to create an integrated synthetic battlespace, replicating a Contemporary Operational Environment (COE) and populating the common operational picture. WARSIM Interfaces with Commanders and Staff organic Command and Control (C2) equipment to create a training environment indistinguishable from the real world by the training audience. WARSIM is a training device used to train Army Commanders and their Staffs at the Brigade and higher echelons in Army Warfighters and Mission Rehearsal Exercises. WARSIM includes an intelligence subcomponent, formally known as WIM, which has been fully integrated within the WARSIM system.

Operator/Task Description:
No specific scenarios were identified. This platform is currently under development (September 2005).

1 Team Factors

- 1.1 Team Structure
  - 1.1.1 Leadership
    - Transactional ☐
    - Transformational ☐
- 1.2 Team Composition
  - 1.2.1 Individual Traits
    - 1.2.1.1 Personality
      - Agreeableness ☐
      - Conscientiousness ☐
      - Emotional stability ☐
      - Extraversion ☐
      - Openness ☐
    - 1.2.1.2 Cognitive ability
      - General cognitive ability ☐
      - Spatial orientation ☐
      - Verbal comprehension ☐
      - Reasoning ability ☐
  - 1.2.2 Team Diversity
    - Heterogeneous ☐
    - Homogenous ☐

2 Task Factors

- 2.1 Task Type
  - Additive ☐
  - Conjunctive ☐
  - Disjunctive ☐
  - Discretionary ☐
  - Executive ☐
  - Command ☑
  - Negotiation ☐
  - Commissions ☐
  - Advisory ☐
  - Design ☐
- 2.2 Task Characteristics
  - 2.2.1 Task Complexity
    - Scope ☐
    - Structurability ☐
    - Uncertainty ☐
  - 2.2.2 Workload
    - Physical ☐
    - Cognitive ☐
    - Emotional ☐
    - Time pressure ☐
  - 2.2.3 Task Interdependence ☐

3 Team Intervention

- 3.1 Team Training
  - Cross training ☐
  - Team coordination training ☐
  - Team self-correction ☐
  - Assertiveness training ☐
- 3.2 Team Building ☐
- 3.3 Feedback and Goal Setting ☐

4 Team Processes

- 4.1 Shared Knowledge
  - 4.1.1 Mental Models ☐
  - 4.1.2 Situational Awareness ☐
  - 4.1.3 Transactive memory ☐
- 4.2 Communication
  - 4.2.1 Need
    - Communication Frequency ☐
    - Team Structure ☐
  - 4.2.2 Efficiency
    - Anticipation Ratios ☐
    - Team Structure ☐
  - 4.2.3 Technology ☐
  - 4.2.4 Type
    - Implicit vs. Explicit ☐
    - Heterogen vs. Homogen ☐
- 4.3 Team Adaptability
  - 4.3.1 Error Correction ☐
  - 4.3.2 Monitoring ☐
  - 4.3.3 Backing-Up ☐
- 4.4 Planning
  - 4.4.1 Allocation of Resources ☐
    - Personnel ☑
    - Time ☐
    - Material ☐
    - Energy ☐
- 4.5 Coordination
  - Interdependence ☐
  - Team structure ☐
  - Resource allocation ☐
  - Communication ☐
  - Mental Models ☐
- 4.6 Team Climate
  - Morale ☐
  - Motivation ☐
  - Trust ☐
  - Cohesion ☐
  - Collective Efficacy ☐

5 Measures

- 5.1 Outcome
  - Computer ☑
- 5.2 Process
  - Self-Report ☐
  - Observer ☐
- 5.3 Level of Analysis
  - 5.3.1 Individual ☐
  - 5.3.2 Team ☐
  - Collective vs. Holistic ☐

Discussion/Observations
WARSIM provides a realistic battlefield environment that more closely matches the contemporary operating environment encountered today in Iraq and Afghanistan. WARSIM is perfectly suited to train the geographically dispersed modular Army; Brigade combat teams from different geographic areas will be expected to join in forming Army or Joint Forces command elements. This will demand a distributed training and mission rehearsal capability that WARSIM brings, and with the high operational tempo of today's units, WARSIM will reduce overhead personnel requirements typically levied on training units.

Although this platform met all of the 6 criteria, it was only deemed as "relevant" because of it is partly a constructive simulation and it is mainly used in tactical environments. Also, this platform is in its development stages.

Sources: http://www.peostri.army.mil/PRODUCTS/WARSIM/ and http://www.stsc.hill.af.mil/crosstalk/2005/09/0509Top5_Warsim.pdf

Platform Name: The Cirrus Mine Hunting Simulation System (MHSS)
Reference Number: 43
Organization: Australian Department of Defence
Relevance: Somewhat Relevant
Domain: Mine Hunting

Customized Workstations	☑	Ad Hoc:	Capable
Communication Channels	☐	Interdisciplinary:	No
Customized Scenarios	☐	Interagency:	No
Platform Type:		Joint:	No
Fidelity:	High	Distributed:	No
Team Size:	Small	Teams of Teams:	Yes
Primary Purpose:	Training	Level of Activity:	Tactical

Platform Description:
The Cirrus Mine Hunting Simulation System (MHSS) has been developed in close cooperation with the Royal Australian Navy to provide cost effective simulation training in mine hunting.

Emulation of sonar consoles supports basic familiarisation of students in the control of their ship-fit minehunting sonar and associated tactical data management system. The training network of 10 consoles facilitates the bulk training of personnel.

Operator/Task Description:
No specific scenarios were identified. There are packaged scenarios available with 3 levels of difficulty to progressively introduce trainees to mine hunting challenges.

1 Team Factors

- 1.1 Team Structure
  - 1.1.1 Leadership
    - Transactional ☐
    - Transformational ☐
- 1.2 Team Composition
  - 1.2.1 Individual Traits
    - 1.2.1.1 Personality
      - Agreeableness ☐
      - Conscientiousness ☐
      - Emotional stability ☐
      - Extraversion ☐
      - Openness ☐
    - 1.2.1.2 Cognitive ability
      - General cognitive ability ☐
      - Spatial orientation ☐
      - Verbal comprehension ☐
      - Reasoning ability ☐
  - 1.2.2 Team Diversity
    - Heterogeneous ☐
    - Homogenous ☐

2 Task Factors

- 2.1 Task Type
  - Additive ☐
  - Conjunctive ☐
  - Disjunctive ☐
  - Discretionary ☐
  - Executive ☐
  - Command ☑
  - Negotiation ☐
  - Commissions ☐
  - Advisory ☐
  - Design ☐
- 2.2 Task Characteristics
  - 2.2.1 Task Complexity
    - Scope ☐
    - Structurability ☐
    - Uncertainty ☐
  - 2.2.2 Workload
    - Physical ☑
    - Cognitive ☑
    - Emotional ☐
    - Time pressure ☐
  - 2.2.3 Task Interdependence ☐

3 Team Intervention

- 3.1 Team Training
  - Cross training ☐
  - Team coordination training ☑
  - Team self-correction ☐
  - Assertiveness training ☐
- 3.2 Team Building ☐
- 3.3 Feedback and Goal Setting ☐

4 Team Processes

- 4.1 Shared Knowledge
  - 4.1.1 Mental Models ☐
  - 4.1.2 Situational Awareness ☐
  - 4.1.3 Transactive memory ☐
- 4.2 Communication
  - 4.2.1 Need
    - Communication Frequency ☐
    - Team Structure ☐
  - 4.2.2 Efficiency
    - Anticipation Ratios ☐
    - Team Structure ☐
  - 4.2.3 Technology ☐
  - 4.2.4 Type
    - Implicit vs. Explicit ☐
    - Heterogen vs. Homogen ☐
- 4.3 Team Adaptability
  - 4.3.1 Error Correction ☐
  - 4.3.2 Monitoring ☐
  - 4.3.3 Backing-Up ☐
- 4.4 Planning
  - 4.4.1 Allocation of Resources ☐
    - Personnel ☐
    - Time ☐
    - Material ☐
    - Energy ☐
- 4.5 Coordination
  - Interdependence ☐
  - Team structure ☐
  - Resource allocation ☐
  - Communication ☐
  - Mental Models ☐
- 4.6 Team Climate
  - Morale ☐
  - Motivation ☐
  - Trust ☐
  - Cohesion ☐
  - Collective Efficacy ☐

5 Measures

- 5.1 Outcome
  - Computer ☑
- 5.2 Process
  - Self-Report ☐
  - Observer ☑
- 5.3 Level of Analysis
  - 5.3.1 Individual ☑
  - 5.3.2 Team ☑
  - Collective vs. Holistic ☐

Discussion/Observations
This is a high fidelity simulator, with high performance sonar image emulation engine that drives the simulation. Characteristics of the sea bed, the contacts, the environment, the sensor and operator controls are all realistically simulated, maximizing trainee understanding of mine-hunting acoustics.

Instructors can easily monitor trainees progress. There was no specific description for team tasks only a statement that there is 3x3 mode, for command team training.

Source: http://www.defence.gov.au/teamaustralia/indexb53c.html and http://www.cirrusrtps.com.au/Cirrus%20MHSS.pdf

Platform Name: Anti-Submarine Warfare Simulation
Reference Number: 23
Organization: Rheinmetall Defence Electronics, Denmark
Relevance: Somewhat Relevant
Domain: Naval

Customized Workstations	☑	Ad Hoc:	No
Communication Channels	☐	Interdisciplinary:	No
Customized Scenarios	☐	Interagency:	No
Platform Type:	Virtual	Joint:	No
Fidelity:	Missing Info	Distributed:	No
Team Size:	Small	Teams of Teams:	No
Primary Purpose:	Training	Level of Activity:	Tactical

Platform Description:
The ASW Team Trainer realistically simulates tactical situations and sea environments for ASW command and control operations. Images present trainees with ultra-realistic impressions of motion, geometry and position, relative to navigation marks, coastal terrains and other vessels.

Operator/Task Description:
No specific scenarios were identified.

1 Team Factors
- 1.1 Team Structure
  - 1.1.1 Leadership
    - Transactional ☐
    - Transformational ☐
- 1.2 Team Composition
  - 1.2.1 Individual Traits
    - 1.2.1.1 Personality
      - Agreeableness ☐
      - Conscientiousness ☐
      - Emotional stability ☐
      - Extraversion ☐
      - Openness ☐
    - 1.2.1.2 Cognitive ability
      - General cognitive ability ☐
      - Spatial orientation ☐
      - Verbal comprehension ☐
      - Reasoning ability ☐
  - 1.2.2 Team Diversity
    - Heterogeneous ☐
    - Homogenous ☐

2 Task Factors
- 2.1 Task Type
  - Additive ☐
  - Conjunctive ☐
  - Disjunctive ☐
  - Discretionary ☐
  - Executive ☐
  - Command ☐
  - Negotiation ☐
  - Commissions ☐
  - Advisory ☐
  - Design ☐
- 2.2 Task Characteristics
  - 2.2.1 Task Complexity
    - Scope ☐
    - Structurability ☐
    - Uncertainty ☐
  - 2.2.2 Workload
    - Physical ☐
    - Cognitive ☐
    - Emotional ☐
    - Time pressure ☐
  - 2.2.3 Task Interdependence ☐

3 Team Intervention
- 3.1 Team Training
  - Cross training ☐
  - Team coordination training ☐
  - Team self-correction ☐
  - Assertiveness training ☐
- 3.2 Team Building ☐
- 3.3 Feedback and Goal Setting ☐

4 Team Processes
- 4.1 Shared Knowledge
  - 4.1.1 Mental Models ☐
  - 4.1.2 Situational Awareness ☐
  - 4.1.3 Transactive memory ☐
- 4.2 Communication
  - 4.2.1 Need
    - Communication Frequency ☐
    - Team Structure ☐
  - 4.2.2 Efficiency
    - Anticipation Ratios ☐
    - Team Structure ☐
  - 4.2.3 Technology ☐
  - 4.2.4 Type
    - Implicit vs. Explicit ☐
    - Heterogen vs. Homogen ☐
- 4.3 Team Adaptability
  - 4.3.1 Error Correction ☐
  - 4.3.2 Monitoring ☐
  - 4.3.3 Backing-Up ☐
- 4.4 Planning
  - 4.4.1 Allocation of Resources ☐
    - Personnel ☐
    - Time ☐
    - Material ☐
    - Energy ☐
- 4.5 Coordination
  - Interdependence ☐
  - Team structure ☐
  - Resource allocation ☐
  - Communication ☐
  - Mental Models ☐
- 4.6 Team Climate
  - Morale ☐
  - Motivation ☐
  - Trust ☐
  - Cohesion ☐
  - Collective Efficacy ☐

5 Measures
- 5.1 Outcome
  - Computer ☐
- 5.2 Process
  - Self-Report ☐
  - Observer ☐
- 5.3 Level of Analysis
  - 5.3.1 Individual ☐
  - 5.3.2 Team ☐
  - Collective vs. Holistic ☐

Discussion/Observations
There was not much information provided on this platform (thus the lack of mapping). Note that RHEINMETALL DEFENCE ELECTRONICS covers a broad spectrum of services in the simulation field including: Nautical and tactical simulation, Traffic and driving simulation, flight simulation part task/full mission, tank gunnery and combat simulation, battlefield and direct fire weapon effects simulation, and Power plant and process simulation.

Source: http://www.naval-technology.com/contractors/simulators/stn/index.html

Platform Name: Battle Management Command and Control (BMC2)
Reference Number: 24
Organization: U.S. Air Force Research Lab - Decision-Making and Automation Research Testbed DART Lab
Relevance: Somewhat Relevant
Domain: Air

Customized Workstations	☑	Ad Hoc:	No
Communication Channels	☑	Interdisciplinary:	No
Customized Scenarios	☑	Interagency:	No
Platform Type:	Virtual	Joint:	No
Fidelity:	Medium	Distributed:	Capable
Team Size:	Small	Teams of Teams:	No
Primary Purpose:	Other	Level of Activity:	Tactical

Platform Description:
The BMC2 lab has the capability to portray high degree of realism while maintaining a suitable degree of experimental control. The BMC2 lab (formerly known as the Multi-sensory Overview Large-scale Tactical Knowledge Environment (MOLTKE) lab) is a medium-fidelity simulation of an Airborne Warning And Control System (AWACS) environment. The laboratory consists of six workstations arranged in two rows of three facing each other, similar to a console arrangement on the AWACS E-3 aircraft. The primary purpose of the BMC2 lab is to examine the readiness of potential technologies in Air Battle Management (ABM). Operators on these platforms typically use interfaces that are manually intensive, cluttered, and require a significant amount of verbal communication.

Operator/Task Description:
No specific scenarios were identified. Some experiments using this platform are identified in the discussion.

1 Team Factors
- 1.1 Team Structure
  - 1.1.1 Leadership
    - Transactional ☐
    - Transformational ☐
  - 1.2 Team Composition
    - 1.2.1 Individual Traits
      - 1.2.1.1 Personality
        - Agreeableness ☐
        - Conscientiousness ☐
        - Emotional stability ☐
        - Extraversion ☐
        - Openness ☐
      - 1.2.1.2 Cognitive ability
        - General cognitive ability ☐
        - Spatial orientation ☐
        - Verbal comprehension ☐
        - Reasoning ability ☐
    - 1.2.2 Team Diversity
      - Heterogeneous ☐
      - Homogeneous ☐

2 Task Factors
- 2.1 Task Type
  - Additive ☐
  - Conjunctive ☐
  - Disjunctive ☐
  - Discretionary ☐
  - Executive ☐
  - Command ☐
  - Negotiation ☐
  - Commissions ☐
  - Advisory ☐
  - Design ☐
- 2.2 Task Characteristics
  - 2.2.1 Task Complexity
    - Scope ☐
    - Structurability ☐
    - Uncertainty ☐
  - 2.2.2 Workload
    - Physical ☑
    - Cognitive ☑
    - Emotional ☐
    - Time pressure ☐
  - 2.2.3 Task Interdependence ☐

3 Team Intervention
- 3.1 Team Training
  - Cross training ☐
  - Team coordination training ☐
  - Team self-correction ☐
  - Assertiveness training ☐
- 3.2 Team Building ☐
- 3.3 Feedback and Goal Setting ☐

4 Team Processes
- 4.1 Shared Knowledge
  - 4.1.1 Mental Models ☐
  - 4.1.2 Situational Awareness ☐
  - 4.1.3 Transactive memory ☐
- 4.2 Communication
  - 4.2.1 Need
    - Communication Frequency ☑
    - Team Structure ☐
  - 4.2.2 Efficiency
    - Anticipation Ratios ☐
    - Team Structure ☐
  - 4.2.3 Technology ☐
  - 4.2.4 Type
    - Implicit vs. Explicit ☐
    - Heterogen vs. Homogen ☐
- 4.3 Team Adaptability
  - 4.3.1 Error Correction ☐
  - 4.3.2 Monitoring ☐
  - 4.3.3 Backing-Up ☐
- 4.4 Planning
  - 4.4.1 Allocation of Resources ☐
    - Personnel ☐
    - Time ☐
    - Material ☐
    - Energy ☐
- 4.5 Coordination
  - Interdependence ☐
  - Team structure ☐
  - Resource allocation ☐
  - Communication ☐
  - Mental Models ☐
- 4.6 Team Climate
  - Morale ☐
  - Motivation ☐
  - Trust ☐
  - Cohesion ☐
  - Collective Efficacy ☐

5 Measures
- 5.1 Outcome
  - Computer ☐
- 5.2 Process
  - Self-Report ☐
  - Observer ☑
- 5.3 Level of Analysis
  - 5.3.1 Individual ☐
  - 5.3.2 Team ☐
  - Collective vs. Holistic ☐

Discussion/Observations
The BMC2 lab has been instrumental in evaluating the effectiveness of spatial audio displays (Nelson, & Bolia, 2003), and speech recognition (Guilliams et al., 2004) in simulated air battle management environments (see also Vidulich et al., 2004). **Spatial audio, mission phase and chatter level served as experimental factors** in the evaluation of spatial audio displays. Ten trained Air Weapons Officers participated in an experiment that emulated a Close Air Support mission. Speech intelligibility was measured as the dependent variable. The results indicated that speech intelligibility was degraded during the more demanding experimental conditions and that spatial audio moderately alleviated this degradation. Additionally, faster response times for the correct identification of critical call signs were demonstrated when spatial audio was present.
A similar ABM scenario was used to evaluate the maturity and appropriateness level of speech recognition technology to offset some of the workload experienced by current operators. Twelve trained Air Weapons Officers participated in the scenario and the results suggested that speech recognition significantly reduced the amount of time operators took to complete their set-up, in applied evaluations suggest that these technologies may be mature enough to start planning the transition to field operations.

This platform does not focus on team performance.

Source: http://www.naval-technology.com/contractors/simulators/stn/index.html

Platform Name: Bolo: The multi-player battle game
Reference Number: 25
Organization: Computer Shareware
Relevance: Somewhat Relevant
Domain: Military General

Customized Workstations	☑	Ad Hoc:	Capable
Communication Channels	☐	Interdisciplinary:	No
Customized Scenarios	☑	Interagency:	No
Platform Type:	Virtual	Joint:	No
Fidelity:	Low	Distributed:	Yes
Team Size:	Small	Teams of Teams:	No
Primary Purpose:	Computer Game	Level of Activity:	Tactical

Platform Description:
A computer-simulated tank exercise (destroy pillboxes while minimizing tank losses) for the PowerPC macintoshes.

Operator/Task Description:
Team members were seated side by side at three computers, and each controlled an on-screen "tank" and worked in a computerized alliance with fellow team members. Teams' targets were sixteen enemy "pillboxes". Members' tanks were armed and could fire at pillboxes, but they had to replenish supplies at one of twelve refueling bases when ammunition was depleted. Teamwork is required in BOLO, because while it is extremely difficult for a single tank to destroy a pillbox, tanks working together can readily do so.

1 Team Factors
- 1.1 Team Structure
  - 1.1.1 Leadership
    - Transactional ☐
    - Transformational ☐
- 1.2 Team Composition
  - 1.2.1 Individual Traits
    - 1.2.1.1 Personality
      - Agreeableness ☐
      - Conscientiousness ☐
      - Emotional stability ☐
      - Extraversion ☐
      - Openness ☐
    - 1.2.1.2 Cognitive ability
      - General cognitive ability ☐
      - Spatial orientation ☐
      - Verbal comprehension ☐
      - Reasoning ability ☐
  - 1.2.2 Team Diversity
    - Heterogeneous ☑
    - Homogenous ☐

2 Task Factors
- 2.1 Task Type
  - Additive ☐
  - Conjunctive ☐
  - Disjunctive ☐
  - Discretionary ☐
  - Executive ☐
  - Command ☐
  - Negotiation ☐
  - Commissions ☐
  - Advisory ☐
  - Design ☐
- 2.2 Task Characteristics
  - 2.2.1 Task Complexity
    - Scope ☐
    - Structurability ☐
    - Uncertainty ☐
  - 2.2.2 Workload
    - Physical ☐
    - Cognitive ☐
    - Emotional ☐
    - Time pressure ☐
  - 2.2.3 Task Interdependence ☑

3 Team Intervention
- 3.1 Team Training
  - Cross training ☐
  - Team coordination training ☐
  - Team self-correction ☐
  - Assertiveness training ☐
- 3.2 Team Building ☐
- 3.3 Feedback and Goal Setting ☐

4 Team Processes
- 4.1 Shared Knowledge
  - 4.1.1 Mental Models ☐
  - 4.1.2 Situational Awareness ☐
  - 4.1.3 Transactive memory ☐
- 4.2 Communication
  - 4.2.1 Need
    - Communication Frequency ☐
    - Team Structure ☐
  - 4.2.2 Efficiency
    - Anticipation Ratios ☐
    - Team Structure ☐
  - 4.2.3 Technology ☐
  - 4.2.4 Type
    - Implicit vs. Explicit ☐
    - Heterogen vs. Homogen ☐
- 4.3 Team Adaptability
  - 4.3.1 Error Correction ☐
  - 4.3.2 Monitoring ☐
  - 4.3.3 Backing-Up ☐
- 4.4 Planning
  - 4.4.1 Allocation of Resources ☐
    - Personnel ☐
    - Time ☐
    - Material ☐
    - Energy ☐
- 4.5 Coordination
  - Interdependence ☐
  - Team structure ☐
  - Resource allocation ☐
  - Communication ☐
  - Mental Models ☐
- 4.6 Team Climate
  - Morale ☐
  - Motivation ☐
  - Trust ☐
  - Cohesion ☐
  - Collective Efficacy ☑

5 Measures
- 5.1 Outcome
  - Computer ☐
- 5.2 Process
  - Self-Report ☐
  - Observer ☐
- 5.3 Level of Analysis
  - 5.3.1 Individual ☐
  - 5.3.2 Team ☐
  - Collective vs. Holistic ☐

Discussion/Observations
From the article "The relationship of team goals, incentives, and efficacy to strategic risk, tactical implementation, and performance," (Knight, Durham, and Locke, in press), in addition to manipulating goal difficulty and incentives, measurable variables include team efficacy, strategic risk, tactical implementation, team performance, and team ability.

Sources: Article: The relationship of team goals, incentives, and efficacy to strategic risk, tactical implementation, and performance; Don Knight, Cathy C. Durham, Edwin A. Locke, 2005 In Press and http://www.twinforces.com/tf/bolo3d.html

Platform Name: Comanche 2.0
Reference Number: 26
Organization: Novalogic
Relevance: Somewhat Relevant
Domain: Air

Customized Workstations	☑	Ad Hoc:	Yes
Communication Channels	☐	Interdisciplinary:	Yes
Customized Scenarios	☐	Interagency:	No
Platform Type:	Virtual	Joint:	No
Fidelity:	Low	Distributed:	No
Team Size:	Small	Teams of Teams:	Missing info
Primary Purpose:	Training	Level of Activity:	Operational

Platform Description:
PC-based helicopter flight and combat simulator.

Operator/Task Description:
3-person teams performed a simulated helicopter rescue-and-relief mission.

1 Team Factors

- 1.1 Team Structure
  - 1.1.1 Leadership
    - Transactional ☐
    - Transformational ☐
- 1.2 Team Composition
  - 1.2.1 Individual Traits
    - 1.2.1.1 Personality
      - Agreeableness ☐
      - Conscientiousness ☐
      - Emotional stability ☐
      - Extraversion ☐
      - Openness ☐
    - 1.2.1.2 Cognitive ability
      - General cognitive ability ☑
      - Spatial orientation ☐
      - Verbal comprehension ☐
      - Reasoning ability ☐
  - 1.2.2 Team Diversity
    - Heterogeneous ☐
    - Homogenous ☐

2 Task Factors

- 2.1 Task Type
  - Additive ☐
  - Conjunctive ☐
  - Disjunctive ☐
  - Discretionary ☐
  - Executive ☐
  - Command ☐
  - Negotiation ☐
  - Commissions ☐
  - Advisory ☐
  - Design ☐
- 2.2 Task Characteristics
  - 2.2.1 Task Complexity
    - Scope ☐
    - Structurability ☐
    - Uncertainty ☐
  - 2.2.2 Workload
    - Physical ☐
    - Cognitive ☑
    - Emotional ☐
    - Time pressure ☐
  - 2.2.3 Task Interdependence ☐

3 Team Intervention

- 3.1 Team Training
  - Cross training ☑
  - Team coordination training ☐
  - Team self-correction ☐
  - Assertiveness training ☐
- 3.2 Team Building ☐
- 3.3 Feedback and Goal Setting ☐

4 Team Processes

- 4.1 Shared Knowledge
  - 4.1.1 Mental Models ☑
  - 4.1.2 Situational Awareness ☐
  - 4.1.3 Transactive memory ☐
- 4.2 Communication
  - 4.2.1 Need
    - Communication Frequency ☐
    - Team Structure ☐
  - 4.2.2 Efficiency
    - Anticipation Ratios ☐
    - Team Structure ☐
  - 4.2.3 Technology ☐
  - 4.2.4 Type
    - Implicit vs. Explicit ☐
    - Heterogen vs. Homogen ☐
- 4.3 Team Adaptability
  - 4.3.1 Error Correction ☐
  - 4.3.2 Monitoring ☐
  - 4.3.3 Backing-Up ☐
- 4.4 Planning
  - 4.4.1 Allocation of Resources ☐
    - Personnel ☐
    - Time ☐
    - Material ☐
    - Energy ☐
- 4.5 Coordination
  - Interdependence ☐
  - Team structure ☐
  - Resource allocation ☐
  - Communication ☐
  - Mental Models ☐
- 4.6 Team Climate
  - Morale ☐
  - Motivation ☐
  - Trust ☐
  - Cohesion ☐
  - Collective Efficacy ☐

5 Measures

- 5.1 Outcome
  - Computer ☐
- 5.2 Process
  - Self-Report ☑
  - Observer ☐
- 5.3 Level of Analysis
  - 5.3.1 Individual ☑
  - 5.3.2 Team ☑
  - Collective vs. Holistic ☐

Discussion/Observations

From the article, "Measuring Team Knowledge: A Window to the Cognitive Underpinnings of Team Performance," (Cooke et al., 2003), the authors report an effort aimed at developing and evaluating **measures of taskwork** and **teamwork team knowledge** for teams in which **members differ in knowledge backgrounds**. These measures were used in a study with 36 teams to explore the **cognitive** underpinnings of team performance variations due to **cross-training** regime. The authors demonstrate that these measures are valid and provide team performance information that complements outcome and behavioral measures. Teams exposed to full cross-training acquired more taskwork and teamwork knowledge than control teams or teams exposed to a conceptual version of cross-training. Measures of team knowledge provide information regarding team task performance critical for system design and training programs.

Note: The mapping was done considering the objective of this particular experiment. Synthetic team task environment, provides adequate experimental control while at the same time preserves the cognitive fidelity of operational tasks.

Source: Article: Measuring Team Knowledge: A Window to the Cognitive Underpinnings of Team Performance; Cooke, Salas, Kiekel, Stout, Bowers and Cannon-Bowers, 2003

Platform Name: Dangerous Waters
Reference Number: 27
Organization: Sonalysts Combat Simulations
Relevance: Somewhat Relevant
Domain: Naval

Customized Workstations	☐	Ad Hoc:	Capable
Communication Channels	☐	Interdisciplinary:	Capable
Customized Scenarios	☑	Interagency:	No
Platform Type:	Virtual	Joint:	Yes
Fidelity:	Missing Info	Distributed:	Yes
Team Size:	Scaleable	Teams of Teams:	Yes
Primary Purpose:	Video Game	Level of Activity:	Tactical

Platform Description:
Dangerous Waters simulates an Oliver Hazard Perry Class Guided Missile Fast Frigate, its MH-60R multi-mission helicopter or a P-3C Orion ASW/ASUW aircraft. The platform also simulates the U.S. Seawolf or Improved Los Angeles Class Nuclear Submarine, Russian Akula I Improved or Akula II Nuclear Submarine or an ultra quiet Russian or Chinese Kilo diesel sub. The Multiplayer Multi-Station mode allows players to man a specific station aboard a ship, plane or sub with other players taking the role of other crewmembers on the same platform.

Operator/Task Description:
The Multiplayer Multi-Station mode allows players to man a specific station aboard a ship, plane or sub with other players taking the role of other crewmembers on the same platform. As the Commander of the platform the player can either relinquish control of various stations to the automated Autocrew or man all stations manually.

1 Team Factors

- 1.1 Team Structure
  - 1.1.1 Leadership
    - Transactional ☑
    - Transformational ☐
- 1.2 Team Composition
  - 1.2.1 Individual Traits
    - 1.2.1.1 Personality
      - Agreeableness ☐
      - Conscientiousness ☐
      - Emotional stability ☐
      - Extraversion ☐
      - Openness ☐
    - 1.2.1.2 Cognitive ability
      - General cognitive ability ☐
      - Spatial orientation ☐
      - Verbal comprehension ☐
      - Reasoning ability ☐
  - 1.2.2 Team Diversity
    - Heterogeneous ☐
    - Homogenous ☐

2 Task Factors

- 2.1 Task Type
  - Additive ☐
  - Conjunctive ☐
  - Disjunctive ☐
  - Discretionary ☐
  - Executive ☐
  - Command ☑
  - Negotiation ☐
  - Commissions ☐
  - Advisory ☐
  - Design ☐
- 2.2 Task Characteristics
  - 2.2.1 Task Complexity
    - Scope ☑
    - Structurability ☐
    - Uncertainty ☐
  - 2.2.2 Workload
    - Physical ☐
    - Cognitive ☐
    - Emotional ☐
    - Time pressure ☐
  - 2.2.3 Task Interdependence

3 Team Intervention

- 3.1 Team Training
  - Cross training ☐
  - Team coordination training ☐
  - Team self-correction ☐
  - Assertiveness training ☐
- 3.2 Team Building ☐
- 3.3 Feedback and Goal Setting ☑

4 Team Processes

- 4.1 Shared Knowledge
  - 4.1.1 Mental Models ☐
  - 4.1.2 Situational Awareness ☐
  - 4.1.3 Transactive memory ☐
- 4.2 Communication
  - 4.2.1 Need
    - Communication Frequency ☐
    - Team Structure ☐
  - 4.2.2 Efficiency
    - Anticipation Ratios ☐
    - Team Structure ☐
  - 4.2.3 Technology ☐
  - 4.2.4 Type
    - Implicit vs. Explicit ☐
    - Heterogen vs. Homogen ☐
- 4.3 Team Adaptability
  - 4.3.1 Error Correction ☐
  - 4.3.2 Monitoring ☐
  - 4.3.3 Backing-Up ☐
- 4.4 Planning
  - 4.4.1 Allocation of Resources ☐
    - Personnel ☐
    - Time ☐
    - Material ☐
    - Energy ☐
- 4.5 Coordination
  - Interdependence ☐
  - Team structure ☐
  - Resource allocation ☐
  - Communication ☐
  - Mental Models ☐
- 4.6 Team Climate
  - Morale ☐
  - Motivation ☐
  - Trust ☐
  - Cohesion ☐
  - Collective Efficacy ☐

5 Measures

- 5.1 Outcome
  - Computer ☐
- 5.2 Process
  - Self-Report ☐
  - Observer ☐
- 5.3 Level of Analysis
  - 5.3.1 Individual ☐
  - 5.3.2 Team ☐
  - Collective vs. Holistic ☐

Discussion/Observations
There are over 270 meticulously researched and modelled surface, submarine and air units. Authentic simulation of sensor performance both in the air and through the ocean environment challenge the player to detect unknown enemies. Realistic depiction of flight characteristic, buoyancy, air resistance, and gravity provide realistic control and maneuvering. Extensive worldwide database provided by the U.S. Naval Institute www.usni.org offers detailed descriptions of platforms and weaponry to accommodate all possible global conflicts.

Players will compete in campaigns in which their actions have a profound effect on the missions that follow. The use of dynamic elements such as probability of inclusion, dynamic groups of objects, dynamic inclusion of **mission goals**, and rules of engagement (that can change mid-mission) all ensure that the campaigns with never play the same way twice. Upon selecting their platform and mission difficulty level the player will be provided with an entirely random and dynamic scenario. It will be composed of an infinite combination of mission goals, enemy forces and random locations. This video game is the first title of its kind allowing the player total control over multiple air, surface and subma
There is no focus on studying teams.

Source: http://www.strategyfirst.com/en/games/DangerousWaters/

Platform Name: Extended Air Defense Simulation (EADSIM)
Reference Number: 28
Organization: Air Force Material Command (AFMC)
Relevance: Somewhat Relevant
Domain: Command and Control

Customized Workstations	☑	Ad Hoc:	Capable
Communication Channels	☐	Interdisciplinary:	Yes
Customized Scenarios	☑	Interagency:	Capable
Platform Type:	Constructive	Joint:	Yes
Fidelity:	Medium to High	Distributed:	Yes
Team Size:	Scaleable	Teams of	Yes
Primary Purpose:	Other	Level of Activity:	Operational/Tactical

Platform Description:
EADSIM is used for scenarios ranging from few-on-few to many-on-many. It represents all the missions on both sides. It individually models each platform and the interaction among such platforms. It models the Command and Control (C2) decision process and the communications among the platforms on a message-by-message basis. Intelligence, surveillance, and reconnaissance are explicitly modeled to support offensive and defensive applications.

Operator/Task Description:
No specific scenarios were identified. Models Theatre Missile Defense and Air Defense concepts. EADSIM is used by operational commanders, trainers, and analysts to model the performance and predict the effectiveness of ballistic missiles, surface-to-air missiles, aircraft, and cruise missiles in a variety of user-developed scenarios (specific scenarios were not listed).

1 Team Factors

- 1.1 Team Structure
  - 1.1.1 Leadership
    - Transactional ☑
    - Transformational ☐
  - 1.2 Team Composition
    - 1.2.1 Individual Traits
      - 1.2.1.1 Personality
        - Agreeableness ☐
        - Conscientiousness ☐
        - Emotional stability ☐
        - Extraversion ☐
        - Openness ☐
      - 1.2.1.2 Cognitive ability
        - General cognitive ability ☐
        - Spatial orientation ☐
        - Verbal comprehension ☐
        - Reasoning ability ☐
      - 1.2.2 Team Diversity
        - Heterogeneous ☐
        - Homogenous ☐

2 Task Factors

- 2.1 Task Type
  - Additive ☐
  - Conjunctive ☐
  - Disjunctive ☐
  - Discretionary ☐
  - Executive ☐
  - Command ☑
  - Negotiation ☐
  - Commissions ☐
  - Advisory ☐
  - Design ☐
- 2.2 Task Characteristics
  - 2.2.1 Task Complexity
    - Scope ☐
    - Structurability ☐
    - Uncertainty ☐
  - 2.2.2 Workload
    - Physical ☐
    - Cognitive ☐
    - Emotional ☐
    - Time pressure ☐
  - 2.2.3 Task Interdependence ☐

3 Team Intervention

- 3.1 Team Training
  - Cross training ☐
  - Team coordination training ☑
  - Team self-correction ☐
  - Assertiveness training ☐
- 3.2 Team Building ☐
- 3.3 Feedback and Goal Setting ☐

4 Team Processes

- 4.1 Shared Knowledge
  - 4.1.1 Mental Models ☐
  - 4.1.2 Situational Awareness ☐
  - 4.1.3 Transactive memory ☐
- 4.2 Communication
  - 4.2.1 Need
    - Communication Frequency ☐
    - Team Structure ☐
  - 4.2.2 Efficiency
    - Anticipation Ratios ☐
    - Team Structure ☐
  - 4.2.3 Technology ☐
  - 4.2.4 Type
    - Implicit vs. Explicit ☐
    - Heterogen vs. Homogen ☐
- 4.3 Team Adaptability
  - 4.3.1 Error Correction ☐
  - 4.3.2 Monitoring ☐
  - 4.3.3 Backing-Up ☐
- 4.4 Planning
  - 4.4.1 Allocation of Resources ☐
    - Personnel ☐
    - Time ☐
    - Material ☐
    - Energy ☐
- 4.5 Coordination
  - Interdependence ☐
  - Team structure ☐
  - Resource allocation ☐
  - Communication ☑
  - Mental Models ☐
- 4.6 Team Climate
  - Morale ☐
  - Motivation ☐
  - Trust ☐
  - Cohesion ☐
  - Collective Efficacy ☐

5 Measures

- 5.1 Outcome
  - Computer ☐
- 5.2 Process
  - Self-Report ☐
  - Observer ☐
- 5.3 Level of Analysis
  - 5.3.1 Individual ☐
  - 5.3.2 Team ☐
  - Collective vs. Holistic ☐

Discussion/Observations

Customized communication: EADSIM accommodates message-passing, event-passing, and control-passing.

EADSIM models fixed- and rotary-wing aircraft, tactical ballistic missiles, cruise missiles, infrared and radar sensors, satellites, command and control structures, sensor and communications jammers, communications networks and devices, and fire support in a dynamic environment which includes the effects of terrain and attrition on the outcome of the battle. Of particular note, EADSIM was used successfully by the U.S. Air Force Studies and Analyses Agency (AFSAA) to analyze attrition, Suppression of Enemy Air Defense (SEAD) missions, and refueling operations during DESERT SHIELD/DESERT STORM. DESERT STORM's chief air campaign planner, BGen Glosson, stated that EADSIM "saved lives and equipment."

This platform was rated as only somewhat relevant because it is a constructive model.

Sources: http://afmsrr.afams.af.mil/index.cfm?RID=MDL_AF_1000008 and http://www.eadsim.com/overview.asp

Platform Name: FIRSTplus Radar ATC Simulator
Reference Number: 29
Organization: Raytheon
Relevance: Somewhat Relevant
Domain: Air Traffic Control

Customized Workstations	☑	Ad Hoc:	Capable
Communication Channels	☑	Interdisciplinary:	Yes
Customized Scenarios	☐	Interagency:	Yes
Platform Type:	Virtual	Joint:	Yes
Fidelity:	Missing Info	Distributed:	Capable
Team Size:	Scaleable	Teams of Teams:	No
Primary Purpose:	Training	Level of Activity:	Operational

Platform Description:
The FIRSTplus™ Radar ATC Simulator provides a complete range of modern, operationally accurate and advanced ATC (Air Traffic Control) training systems, supporting enroute, terminal and towercontrol operations for both civil and military users. FIRSTplus™ addresses all levels of training, including ab-initio certification, re-certification and refresher, emergency and conversion courses, as well as R/T phraseology training and self-teach classroom evaluations.

Operator/Task Description:
No specific scenario was identified.

1 Team Factors
- 1.1 Team Structure
  - 1.1.1 Leadership
    - Transactional ☑
    - Transformational ☑
- 1.2 Team Composition
  - 1.2.1 Individual Traits
    - 1.2.1.1 Personality
      - Agreeableness ☐
      - Conscientiousness ☐
      - Emotional stability ☐
      - Extraversion ☐
      - Openess ☐
    - 1.2.1.2 Cognative ability
      - General cognative ability ☐
      - Spatial orientation ☐
      - Verbal comprehension ☐
      - Reasoning ability ☐
  - 1.2.2 Team Diversity
    - Heterogenous ☐
    - Homogenous ☐

2 Task Factors
- 2.1 Task Type
  - Additive ☐
  - Conjunctive ☐
  - Disjunctive ☐
  - Discretionary ☐
  - Executive ☐
  - Command ☐
  - Negotiation ☐
  - Commissions ☐
  - Advisory ☐
  - Design ☐
- 2.2 Task Characteristics
  - 2.2.1 Task Complexity
    - Scope ☐
    - Structurability ☐
    - Uncertainty ☐
  - 2.2.2 Workload
    - Physical ☐
    - Cognitive ☐
    - Emotional ☐
    - Time pressure ☐
  - 2.2.3 Task Interdependence ☐

3 Team Intervention
- 3.1 Team Training
  - Cross training ☐
  - Team coordination training ☑
  - Team self-correction ☑
  - Assertiveness training ☐
- 3.2 Team Building ☐
- 3.3 Feedback and Goal Setting ☐

4 Team Processes
- 4.1 Shared Knowledge
  - 4.1.1 Mental Models ☐
  - 4.1.2 Situational Awareness ☐
  - 4.1.3 Transactive memory ☐
- 4.2 Communication
  - 4.2.1 Need
    - Communication Frequency ☐
    - Team Structure ☐
  - 4.2.2 Efficiency
    - Anticipation Ratios ☐
    - Team Structure ☐
  - 4.2.3 Technology ☑
  - 4.2.4 Type
    - Implicit vs. Explicit ☐
    - Heterogen vs. Homogen ☐
- 4.3 Team Adaptability
  - 4.3.1 Error Correction ☐
  - 4.3.2 Monitoring ☐
  - 4.3.3 Backing-Up ☐
- 4.4 Planning
  - 4.4.1 Allocation of Resources ☐
    - Personnel ☐
    - Time ☐
    - Material ☐
    - Energy ☐
- 4.5 Coordination
  - Interdependence ☐
  - Team structure ☐
  - Resource allocation ☐
  - Communication ☐
  - Mental Models ☐
- 4.6 Team Climate
  - Morale ☐
  - Motivation ☐
  - Trust ☐
  - Cohesion ☐
  - Collective Efficacy ☐

5 Measures
- 5.1 Outcome
  - Computer ☐
- 5.2 Process
  - Self-Report ☐
  - Observer ☐
- 5.3 Level of Analysis
  - 5.3.1 Individual ☐
  - 5.3.2 Team ☐
  - Collective vs. Holistic ☐

Discussion/Observations

The system provides for a complete user-definable environment such as airports, maps, air/ground fixes, air routes, electronic and paper flight strips, sectorization plans, aircraft performance data and weather data.

This platform was rated as only somewhat relevant because of it's primary purpose of training. Also it focuses on individual training versus team training.

Source: http://www.raytheon.com/products/stellent/groups/public/documents/legacy_site/cms01_032544.pdf

Platform Name: Falcon 3.0
Reference Number: 30
Organization: Spectrum Holobyte
Relevance: Somewhat Relevant
Domain: Air

Customized Workstations	☑	Ad Hoc:	Capable
Communication Channels	☑	Interdisciplinary:	Yes
Customized Scenarios	☐	Interagency:	Missing info
Platform Type:	Virtual	Joint:	Missing info
Fidelity:	Low	Distributed:	Missing info
Team Size:	Small	Teams of Teams:	No
Primary Purpose:	Training	Level of Activity:	Tactical

Platform Description:
Personal-computer-based flight simulator task made for the PC (1991), (sequel to Falcon/Falson AT). The software is a computer-generated simulation program of the F-16 fighter fixed-wing aircraft. The program is extremely flexible and enables one to modify several parameters of the simulation.

Operator/Task Description:
Various scenarios can be scripted and controlled in terms of flight plans, aircraft weapons loadouts, the number of enemy and allied planes present, and even the ability and temperment of computer-guided pilots.

1 Team Factors

- 1.1 Team Structure
  - 1.1.1 Leadership
    - Transactional ☐
    - Transformational ☐
- 1.2 Team Composition
  - 1.2.1 Individual Traits
    - 1.2.1.1 Personality
      - Agreeableness ☐
      - Conscientiousness ☐
      - Emotional stability ☐
      - Extraversion ☐
      - Openness ☐
    - 1.2.1.2 Cognitive ability
      - General cognitive ability ☐
      - Spatial orientation ☐
      - Verbal comprehension ☐
      - Reasoning ability ☐
  - 1.2.2 Team Diversity
    - Heterogeneous ☑
    - Homogenous ☐

2 Task Factors

- 2.1 Task Type
  - Additive ☐
  - Conjunctive ☐
  - Disjunctive ☐
  - Discretionary ☐
  - Executive ☐
  - Command ☐
  - Negotiation ☐
  - Commissions ☐
  - Advisory ☐
  - Design ☐
- 2.2 Task Characteristics
  - 2.2.1 Task Complexity
    - Scope ☐
    - Structurability ☐
    - Uncertainty ☐
  - 2.2.2 Workload
    - Physical ☐
    - Cognitive ☐
    - Emotional ☐
    - Time pressure ☐
  - 2.2.3 Task Interdependence ☑

3 Team Intervention

- 3.1 Team Training
  - Cross training ☐
  - Team coordination training ☐
  - Team self-correction ☐
  - Assertiveness training ☐
- 3.2 Team Building ☐
- 3.3 Feedback and Goal Setting ☐

4 Team Processes

- 4.1 Shared Knowledge
  - 4.1.1 Mental Models ☑
  - 4.1.2 Situational Awareness ☐
  - 4.1.3 Transactive memory ☐
- 4.2 Communication
  - 4.2.1 Need
    - Communication Frequency ☐
    - Team Structure ☐
  - 4.2.2 Efficiency
    - Anticipation Ratios ☐
    - Team Structure ☐
  - 4.2.3 Technology ☑
  - 4.2.4 Type
    - Implicit vs. Explicit ☐
    - Heterogen vs. Homogen ☐
- 4.3 Team Adaptability
  - 4.3.1 Error Correction ☐
  - 4.3.2 Monitoring ☐
  - 4.3.3 Backing-Up ☐
- 4.4 Planning
  - 4.4.1 Allocation of Resources ☐
    - Personnel ☐
    - Time ☐
    - Material ☐
    - Energy ☐
- 4.5 Coordination
  - Interdependence ☑
  - Team structure ☑
  - Resource allocation ☑
  - Communication ☐
  - Mental Models ☐
- 4.6 Team Climate
  - Morale ☐
  - Motivation ☐
  - Trust ☐
  - Cohesion ☐
  - Collective Efficacy ☐

5 Measures

- 5.1 Outcome
  - Computer ☐
- 5.2 Process
  - Self-Report ☐
  - Observer ☐
- 5.3 Level of Analysis
  - 5.3.1 Individual ☐
  - 5.3.2 Team ☐
  - Collective vs. Holistic ☐

Discussion/Observations
From the article, "The influence of shared mental models on team process and performance," (Mathieu, Heffner, Goodwin, Salas, and Cannon-Bowers, 2000) The study's main purpose was to investigate the influence of teammates' shared mental models on team processes and performance.

Note: the mapping was conducted considering the objective of the study.

Source: Article: The influence of shared mental models on team process and performance; Mathieu, Goodwin, Heffner, Salas, Cannon-Bowers, 2000

Platform Name: Full Spectrum Warrior
Reference Number: 31
Organization: Panedemic
Relevance: Somewhat Relevant
Domain: Military General

Customized Workstations	☑	Ad Hoc:	No
Communication Channels	☑	Interdisciplinary:	Missing Info
Customized Scenarios	☑	Interagency:	No
Platform Type:	Virtual	Joint:	No
Fidelity:	Missing Info	Distributed:	Missing Info
Team Size:	Scalable, upto medium	Teams of Teams:	No
Primary Purpose:	Video Game	Level of Activity:	Operational/Tactical

Platform Description:
Full Spectrum Warrior is a squad-based, tactical action game that focuses on critical decision making by the Squad Leader (the player). The game is based on a light Infantry training simulator designed by Pandemic Studios for the U.S. Army as a tool to reinforce Army doctrine and team effort among troops, simulating today's urban combat, peace-enforcement, and peacekeeping missions. Full Spectrum Warrior delivers a level of realism and accuracy that has never been seen in a military-based game.

Operator/Task Description:
No specific scenarios were identified.

1 Team Factors
- 1.1 Team Structure
  - 1.1.1 Leadership
    - Transactional ☑
    - Transformational ☐
- 1.2 Team Composition
  - 1.2.1 Individual Traits
    - 1.2.1.1 Personality
      - Agreeableness ☐
      - Conscientiousness ☐
      - Emotional stability ☐
      - Extraversion ☐
      - Openness ☐
    - 1.2.1.2 Cognitive ability
      - General cognitive ability ☐
      - Spatial orientation ☐
      - Verbal comprehension ☐
      - Reasoning ability ☐
  - 1.2.2 Team Diversity
    - Heterogeneous ☐
    - Homogenous ☐

2 Task Factors
- 2.1 Task Type
  - Additive ☐
  - Conjunctive ☐
  - Disjunctive ☐
  - Discretionary ☐
  - Executive ☐
  - Command ☑
  - Negotiation ☐
  - Commissions ☐
  - Advisory ☐
  - Design ☐
- 2.2 Task Characteristics
  - 2.2.1 Task Complexity
    - Scope ☐
    - Structurability ☐
    - Uncertainty ☐
  - 2.2.2 Workload
    - Physical ☐
    - Cognitive ☐
    - Emotional ☐
    - Time pressure ☐
  - 2.2.3 Task Interdependence ☐

3 Team Intervention
- 3.1 Team Training
  - Cross training ☐
  - Team coordination training ☐
  - Team self-correction ☐
  - Assertiveness training ☐
- 3.2 Team Building ☐
- 3.3 Feedback and Goal Setting ☐

4 Team Processes
- 4.1 Shared Knowledge
  - 4.1.1 Mental Models ☐
  - 4.1.2 Situational Awareness ☐
  - 4.1.3 Transactive memory ☐
- 4.2 Communication
  - 4.2.1 Need
    - Communication Frequency ☐
    - Team Structure ☐
  - 4.2.2 Efficiency
    - Anticipation Ratios ☐
    - Team Structure ☐
  - 4.2.3 Technology ☐
  - 4.2.4 Type
    - Implicit vs. Explicit ☐
    - Heterogen vs. Homogen ☐
- 4.3 Team Adaptability
  - 4.3.1 Error Correction ☐
  - 4.3.2 Monitoring ☐
  - 4.3.3 Backing-Up ☐
- 4.4 Planning
  - 4.4.1 Allocation of Resources ☐
    - Personnel ☐
    - Time ☐
    - Material ☐
    - Energy ☐
- 4.5 Coordination
  - Interdependence ☐
  - Team structure ☑
  - Resource allocation ☐
  - Communication ☐
  - Mental Models ☐
- 4.6 Team Climate
  - Morale ☐
  - Motivation ☐
  - Trust ☐
  - Cohesion ☐
  - Collective Efficacy ☐

5 Measures
- 5.1 Outcome
  - Computer ☐
- 5.2 Process
  - Self-Report ☐
  - Observer ☐
- 5.3 Level of Analysis
  - 5.3.1 Individual ☐
  - 5.3.2 Team ☐
  - Collective vs. Holistic ☐

Discussion/Observations
FSW is based on controlling squads of men. It was created to teach squad leaders how to **command**, not to simulate individual control of soldiers. The successful Squad Leader effectively uses cover in the environment and moves his fire teams in a coordinated fashion so they can protect themselves from possible attacks that could come from any direction. An intuitive control system allows you to control up to eight soldiers in real-time as you outthink, outmaneuver and outgun enemies through over 11 levels of intense combat.

Source: http://www.fullspectrumwarrior.com/gm_faq.php

Platform Name: Integrated Performance Modeling Environment
Reference Number: 32
Organization: TNO Human Factors
Relevance: Somewhat Relevant
Domain: Command and Control

Customized Workstations	☑	Ad Hoc:	Capable
Communication Channels	☑	Interdisciplinary:	Capable
Customized Scenarios	☑	Interagency:	Capable
Platform Type:	Constructive	Joint:	Capable
Fidelity:		Distributed:	Capable
Team Size:	Scaleable	Teams of Teams:	Capable
Primary Purpose:	Other	Level of Activity:	Operational

Platform Description:
This document (van den Dobbelsteen, van den Broek, 2004) investigated whether changes in the team organization could enable reduced manning. A modeling and simulation environment was developed that can establish and visualize the workload levels of team members during mission completion. The modeling and simulation environment enables the exploration of alternative work and team arrangements and allows evaluations of different manning concepts. The Integrated Performance Modeling Environment (IPME) simulation environment was used to test different new organizational structures by measuring the workload of the individual team members and the overall team workload.

Operator/Task Description:
Two scenarios were used: 1) a normal scenario in which the team members normally would have sufficient time to do tasks, and 2) a high-speed scenario in which the team members would be subjected to a high amount of time pressure.

1 Team Factors
- 1.1 Team Structure
  - 1.1.1 Leadership
    - Transactional ☐
    - Transformational ☐
- 1.2 Team Composition
  - 1.2.1 Individual Traits
    - 1.2.1.1 Personality
      - Agreeableness ☐
      - Conscientiousness ☐
      - Emotional stability ☐
      - Extraversion ☐
      - Openness ☐
    - 1.2.1.2 Cognitive ability
      - General cognitive ability ☐
      - Spatial orientation ☐
      - Verbal comprehension ☐
      - Reasoning ability ☐
  - 1.2.2 Team Diversity
    - Heterogeneous ☐
    - Homogenous ☐

2 Task Factors
- 2.1 Task Type
  - Additive ☐
  - Conjunctive ☐
  - Disjunctive ☐
  - Discretionary ☐
  - Executive ☐
  - Command ☐
  - Negotiation ☐
  - Commissions ☐
  - Advisory ☐
  - Design ☐
- 2.2 Task Characteristics
  - 2.2.1 Task Complexity
    - Scope ☐
    - Structurability ☑
    - Uncertainty ☐
  - 2.2.2 Workload
    - Physical ☑
    - Cognitive ☑
    - Emotional ☐
    - Time pressure ☑
  - 2.2.3 Task Interdependence ☐

3 Team Intervention
- 3.1 Team Training
  - Cross training ☐
  - Team coordination training ☐
  - Team self-correction ☐
  - Assertiveness training ☐
- 3.2 Team Building ☐
- 3.3 Feedback and Goal Setting ☐

4 Team Processes
- 4.1 Shared Knowledge
  - 4.1.1 Mental Models ☐
  - 4.1.2 Situational Awareness ☐
  - 4.1.3 Transactive memory ☐
- 4.2 Communication
  - 4.2.1 Need
    - Communication Frequency ☑
    - Team Structure ☐
  - 4.2.2 Efficiency
    - Anticipation Ratios ☐
    - Team Structure ☐
  - 4.2.3 Technology ☐
  - 4.2.4 Type
    - Implicit vs. Explicit ☐
    - Heterogen vs. Homogen ☐
- 4.3 Team Adaptability
  - 4.3.1 Error Correction ☐
  - 4.3.2 Monitoring ☐
  - 4.3.3 Backing-Up ☐
- 4.4 Planning
  - 4.4.1 Allocation of Resources ☐
    - Personnel ☐
    - Time ☐
    - Material ☐
    - Energy ☐
- 4.5 Coordination
  - Interdependence ☐
  - Team structure ☑
  - Resource allocation ☐
  - Communication ☐
  - Mental Models ☐
- 4.6 Team Climate
  - Morale ☐
  - Motivation ☐
  - Trust ☐
  - Cohesion ☐
  - Collective Efficacy ☐

5 Measures
- 5.1 Outcome
  - Computer ☐
- 5.2 Process
  - Self-Report ☐
  - Observer ☐
- 5.3 Level of Analysis
  - 5.3.1 Individual ☐
  - 5.3.2 Team ☐
  - Collective vs. Holistic ☐

Discussion/Observations
Communication and coordination between the different team members were built into the model. Modeling-based team design enables predictions about the functioning of command teams within future team organizations because it provides insight in the relations between manning sizes, distribution of work, way of work, workload, and team performance.

This platform was rated as only somewhat relevant because it is constructive (will be further examined in Task 3: Tool Evaluation).

Source: http://www.casos.cs.cmu.edu/events/conferences/2004/2004_proceedings/vandenDobbelsteen_Gerard.doc

Platform Name: Joint Strike Fighter Full-Mission Simulation
Reference Number: 33
Organization: Boeing
Relevance: Somewhat Relevant
Domain: Air

Customized Workstations	☐	Ad Hoc:	Missing info
Communication Channels	☑	Interdisciplinary:	Yes
Customized Scenarios	☐	Interagency:	No
Platform Type:	Virtual	Joint:	No
Fidelity:	High	Distributed:	Yes
Team Size:	Small	Teams of Teams:	Capable
Primary Purpose:	Other	Level of Activity:	Operational

Platform Description:
The Integrated Technology Development Laboratories (ITDL) provides core simulation capabilities to support analysis and valuation of future weapon systems for effectiveness in a battlefield environment. It is specifically dedicated to the design and evaluation of high-performance aircraft, including surveillance and command and control aircraft, and the systems that support them.

Operator/Task Description:
Joint Strike Fighter (JSF) uses operational mission scenarios.

1 Team Factors
- 1.1 Team Structure
  - 1.1.1 Leadership
    - Transactional ☐
    - Transformational ☐
- 1.2 Team Composition
  - 1.2.1 Individual Traits
    - 1.2.1.1 Personality
      - Agreeableness ☐
      - Conscientiousness ☐
      - Emotional stability ☐
      - Extraversion ☐
      - Openness ☐
    - 1.2.1.2 Cognative ability
      - General cognitive ability ☐
      - Spatial orientation ☐
      - Verbal comprehension ☐
      - Reasoning ability ☐
  - 1.2.2 Team Diversity
    - Heterogeneous ☐
    - Homogenous ☐

2 Task Factors
- 2.1 Task Type
  - Additive ☐
  - Conjunctive ☐
  - Disjunctive ☐
  - Discretionary ☐
  - Executive ☐
  - Command ☐
  - Negotiation ☐
  - Commissions ☐
  - Advisory ☐
  - Design ☐
- 2.2 Task Characteristics
  - 2.2.1 Task Complexity
    - Scope ☐
    - Structurability ☐
    - Uncertainty ☐
  - 2.2.2 Workload
    - Physical ☐
    - Cognitive ☐
    - Emotional ☐
    - Time pressure ☐
  - 2.2.3 Task Interdependence

3 Team Intervention
- 3.1 Team Training
  - Cross training ☐
  - Team coordination training ☐
  - Team self-correction ☐
  - Assertiveness training ☐
- 3.2 Team Building ☐
- 3.3 Feedback and Goal Setting ☐

4 Team Processes
- 4.1 Shared Knowledge
  - 4.1.1 Mental Models ☐
  - 4.1.2 Situational Awareness ☐
  - 4.1.3 Transactive memory ☐
- 4.2 Communication
  - 4.2.1 Need
    - Communication Frequency ☐
    - Team Structure ☐
  - 4.2.2 Efficiency
    - Anticipation Ratios ☐
    - Team Structure ☐
  - 4.2.3 Technology ☑
  - 4.2.4 Type
    - Implicit vs. Explicit ☐
    - Heterogen vs. Homogen ☐
- 4.3 Team Adaptability
  - 4.3.1 Error Correction ☐
  - 4.3.2 Monitoring ☐
  - 4.3.3 Backing-Up ☐
- 4.4 Planning
  - 4.4.1 Allocation of Resources ☐
    - Personnel ☐
    - Time ☐
    - Material ☐
    - Energy ☐
- 4.5 Coordination
  - Interdependence ☐
  - Team structure ☐
  - Resource allocation ☐
  - Communication ☐
  - Mental Models ☐
- 4.6 Team Climate
  - Morale ☐
  - Motivation ☐
  - Trust ☐
  - Cohesion ☐
  - Collective Efficacy ☐

5 Measures
- 5.1 Outcome
  - Computer ☐
- 5.2 Process
  - Self-Report ☐
  - Observer ☐
- 5.3 Level of Analysis
  - 5.3.1 Individual ☐
  - 5.3.2 Team ☐
  - Collective vs. Holistic ☐

Discussion/Observations
The power of the ITDL lies in the linkages between laboratories which uses a high-speed central fiber optic cable that can link 42 labs in the building into myriad configurations depending on requirements.

Source: http://www.boeing.com/phantom/msa/pw_msa.htm and http://www.defense-aerospace.com/cgi-/client/modele.pl?prod=2439&session=dae.16827618.1133274374.Q4xlBsOa9dUAABsevgg&modele=jdc_1

Platform Name: Longbow2, helicopter flight simulator
Reference Number: 34
Organization: Apache
Relevance: Somewhat Relevant
Domain: Air

Customized Workstations	☑	Ad Hoc:	Capable
Communication Channels	☑	Interdisciplinary:	Yes
Customized Scenarios	☑	Interagency:	Missing info
Platform Type:	Virtual	Joint:	Missing info
Fidelity:		Distributed:	Yes
Team Size:	Small	Teams of Teams:	No
Primary Purpose:	Training	Level of Activity:	Operational/Tactical

Platform Description:
PC-based Apache helicopter flight simulator called Longbow2. Longbow2 was originally designed as a two-player simulation, but the task was modified to create a three-person interdependent team.

Operator/Task Description:
Team members worked together as a pilot, gunner, and radar specialist to operate the Apache helicopter and were charged with conducting attack missions in challenging battlefields. The goal of each mission was to fly into enemy territory, destroy enemy targets, and return safely to friendly territory. To accomplish the mission, teams had to navigate a fixed course of waypoints, identify and destroy all enemy targets encountered, and, at the same time, evade enemy attacks on their helicopter. Missions concluded three different ways: a) when a team reached the last waypoint, b) when a team was destroyed by enemy fire, or c) when the 12-min time limit expired.

1 Team Factors

- 1.1 Team Structure
  - 1.1.1 Leadership
    - Transactional ☐
    - Transformational ☐
- 1.2 Team Composition
  - 1.2.1 Individual Traits
    - 1.2.1.1 Personality
      - Agreeableness ☐
      - Conscientiousness ☐
      - Emotional stability ☐
      - Extraversion ☐
      - Openness ☐
    - 1.2.1.2 Cognitive ability
      - General cognitive ability ☐
      - Spatial orientation ☐
      - Verbal comprehension ☐
      - Reasoning ability ☐
  - 1.2.2 Team Diversity
    - Heterogeneous ☑
    - Homogenous ☐

2 Task Factors

- 2.1 Task Type
  - Additive ☑
  - Conjunctive ☐
  - Disjunctive ☐
  - Discretionary ☐
  - Executive ☐
  - Command ☐
  - Negotiation ☐
  - Commissions ☐
  - Advisory ☐
  - Design ☐
- 2.2 Task Characteristics
  - 2.2.1 Task Complexity
    - Scope ☐
    - Structurability ☐
    - Uncertainty ☑
  - 2.2.2 Workload
    - Physical ☐
    - Cognitive ☐
    - Emotional ☐
    - Time pressure ☑
  - 2.2.3 Task Interdependence ☑

3 Team Intervention

- 3.1 Team Training
  - Cross training ☑
  - Team coordination training ☐
  - Team self-correction ☐
  - Assertiveness training ☐
- 3.2 Team Building ☐
- 3.3 Feedback and Goal Setting ☐

4 Team Processes

- 4.1 Shared Knowledge
  - 4.1.1 Mental Models ☑
  - 4.1.2 Situational Awareness ☑
  - 4.1.3 Transactive memory ☐
- 4.2 Communication
  - 4.2.1 Need
    - Communication Frequency ☐
    - Team Structure ☐
  - 4.2.2 Efficiency
    - Anticipation Ratios ☐
    - Team Structure ☐
  - 4.2.3 Technology ☑
  - 4.2.4 Type
    - Implicit vs. Explicit ☐
    - Heterogen vs. Homogen ☐
- 4.3 Team Adaptability
  - 4.3.1 Error Correction ☑
  - 4.3.2 Monitoring ☑
  - 4.3.3 Backing-Up ☑
- 4.4 Planning
  - 4.4.1 Allocation of Resources ☑
    - Personnel ☑
    - Time ☐
    - Material ☐
    - Energy ☑
- 4.5 Coordination
  - Interdependence ☑
  - Team structure ☑
  - Resource allocation ☑
  - Communication ☑
  - Mental Models ☑
- 4.6 Team Climate
  - Morale ☐
  - Motivation ☐
  - Trust ☐
  - Cohesion ☐
  - Collective Efficacy ☐

5 Measures

- 5.1 Outcome
  - Computer ☐
- 5.2 Process
  - Self-Report ☐
  - Observer ☐
- 5.3 Level of Analysis
  - 5.3.1 Individual ☐
  - 5.3.2 Team ☐
  - Collective vs. Holistic ☐

Discussion/Observations
From the article: "The influence Impact of cross-training on Team Effectiveness," (Marks, et al., 2002) and "The infludence of team monitoring on team process and performance," (Marks and Panzer, 2004) The experiments examined the effects of cross-training on shared knowledge structures as an indicator of cross-training effectiveness. Both experiments focused on action teams, a specific type of team that is characterized by interdependence, distribution of tasks and information across specialized individuals, where team effectiveness depends on rapid, complex, and coordinated task behavior, and the ability to dynamically adapt to the shifting demands of the situation. Both studies examined the effects of cross-training on three types of criteria: shared mental models, coordination and back-up behaviors, and overall team performance.

Note: The mapping was done considering the purpose of this experiment.

Source: Article: The impact of cross-training on team effectiveness; Marks, Burke, Sabella, Zaccaro, 2002 and Article: The influence of team monitoring on team process and preformance, Mar

Platform Name: Rhode Island Hospital Medical Simulation Centre
Reference Number: 35
Organization: Rhode Island Hospital
Relevance: Somewhat Relevant
Domain: Medical

Customized Workstations	☐	Ad Hoc:	Capable
Communication Channels	☑	Interdisciplinary:	Yes
Customized Scenarios	☑	Interagency:	Yes
Platform Type:	Virtual	Joint:	No
Fidelity:		Distributed:	No
Team Size:	Scaleable	Teams of Teams:	Yes
Primary Purpose:	Training	Level of Activity:	N/A

Platform Description:
The primary goal of the centre is to improve interdisciplinary team performance. People who function in teams need to be trained as teams. The major component of this platform is a computer controlled "patient", anatomically correct rubberized mannequin. It presents medical teams with all of the vital signs, including pupils that react to light, and lung and heart sounds. This patient even groans.

Operator/Task Description:
No specific scenarios were identified. Selected course offerings at this facility include: Teamwork Training: MedTeams, Advanced Airway Management, Disaster Perparedness Training, Pediatric Acute Airway Management and Teamwork Training, Pediatric Office Emergencies.

1 Team Factors

1.1 Team Structure
- 1.1.1 Leadership
  - Transactional ☐
  - Transformational ☐
- 1.2 Team Composition
- 1.2.1 Individual Traits
  - 1.2.1.1 Personality
    - Agreeableness ☐
    - Conscientiousness ☐
    - Emotional stability ☐
    - Extraversion ☐
    - Openness ☐
  - 1.2.1.2 Cognitive ability
    - General cognitive ability ☑
    - Spatial orientation ☐
    - Verbal comprehension ☐
    - Reasoning ability ☐
- 1.2.2 Team Diversity
  - Heterogeneous ☑
  - Homogenous ☑

2 Task Factors

2.1 Task Type
- Additive ☐
- Conjunctive ☐
- Disjunctive ☐
- Discretionary ☐
- Executive ☐
- Command ☐
- Negotiation ☐
- Commissions ☐
- Advisory ☐
- Design ☐

2.2 Task Characteristics

2.2.1 Task Complexity
- Scope ☐
- Structurability ☐
- Uncertainty ☐

2.2.2 Workload
- Physical ☑
- Cognitive ☑
- Emotional ☐
- Time pressure ☐

2.2.3 Task Interdependence ☑

3 Team Intervention

3.1 Team Training
- Cross training ☐
- Team coordination training ☑
- Team self-correction ☐
- Assertiveness training ☐

3.2 Team Building ☐

3.3 Feedback and Goal Setting ☐

4 Team Processes

4.1 Shared Knowledge
- 4.1.1 Mental Models ☑
- 4.1.2 Situational Awareness ☑
- 4.1.3 Transactive memory ☑

4.2 Communication
- 4.2.1 Need
  - Communication Frequency ☑
  - Team Structure ☑
- 4.2.2 Efficiency
  - Anticipation Ratios ☐
  - Team Structure ☐
- 4.2.3 Technology ☐
- 4.2.4 Type
  - Implicit vs. Explicit ☐
  - Heterogen vs. Homogen ☐

4.3 Team Adaptability
- 4.3.1 Error Correction ☐
- 4.3.2 Monitoring ☐
- 4.3.3 Backing-Up ☐

4.4 Planning
- 4.4.1 Allocation of Resources ☐
  - Personnel ☐
  - Time ☐
  - Material ☐
  - Energy ☐

4.5 Coordination
- Interdependence ☑
- Team structure ☑
- Resource allocation ☑
- Communication ☑
- Mental Models ☑

4.6 Team Climate
- Morale ☐
- Motivation ☐
- Trust ☐
- Cohesion ☐
- Collective Efficacy ☐

5 Measures

5.1 Outcome
- Computer ☐

5.2 Process
- Self-Report ☐
- Observer ☑

5.3 Level of Analysis
- 5.3.1 Individual ☐
- 5.3.2 Team ☐
- Collective vs. Holistic ☐

Discussion/Observations

The center is a 3,000-square-foot replica of an emergency department, with bays that transform into an operating room, critical-care setting or ambulance interior. Behind a wall of one-way mirrors are observers and an audio-visual room housing the mannequin controls. After an exercise, a team and its mentors study videotape of the simulated emergency. Evaluation focuses on roles and responsibilities, problem solving, communications, workload distribution and human factors. (There was no evidence of computer data collection).

The primary purpose of this platform is training to avoid medical errors. "The key to avoiding errors and improving safety is a team approach, which is best practiced in a simulator," Joseph Amaral, MD, president and CEO of Rhode Island hospital and professor of surgery.

Interesting to note: Rhode Island Hospital and its Hasbro Children's Hospital became funded participants in a United States Department of Defense project to transfer the lessons learned from Army aviation to medical teams in emergency departments. MedTeams™—a multi-center military and civilian project (1995 to 1999)—demonstrated the patient safety benefits of implementing a teamwork training curriculum in emergency medicine. The first phase of the study (needs analysis) demonstrated 43 percent of closed claims involved teamwork errors. The validation phase showed a reduction in medical errors by 26.5 percent after implementation of department wide teamwork training. Most recently, investigators at Rhode Island Hospital Medical Simulation Center have provided evidence that medical simulation training enhances didactic learning and improves team performance in the emergency department.

Sources: http://www.lifespan.org/services/simctr/press/default.htm and http://lifespan.org/services/simctr/more.htm

Platform Name: Reconfigurable Tactical Operations Simulator (RTOS)
Reference Number: 36
Organization: Science Applications International Corporation (SAIC)
Relevance: Somewhat Relevant
Domain: Air and Command and Control

Customized Workstations	☑	Ad Hoc:	Capable
Communication Channels	☐	Interdisciplinary:	Yes
Customized Scenarios	☑	Interagency:	No
Platform Type:	Live and Virtual	Joint:	Yes
Fidelity:	High	Distributed:	Yes
Team Size:	Missing Info	Teams of Teams:	Missing info
Primary Purpose:	Other	Level of Activity:	Tactical

Platform Description:
RTOS is used for tactical training and operator performance analysis. The U.S. Army, German Air Force (GAF) and Japanese Air Self-Defense Force (JASDF) have used the RTOS to conduct Analyses in Multiple Areas: Capability Evaluation, Proof of Concept, Software Evaluation, Validation Test, Operator Performance, Deployment Analysis, Effectiveness Analysis, and Requirements Development. Tactical Simulation Model Supports Simple Modification of: Surveillance and Radar, Jamming, Missile, Display, Tracking, Launcher, Command and Control, IFF, Data Links, Engagement Decision, Weapons Assignment

Operator/Task Description:
No specific scenarios were identified. Areas of use are identified in the platform description.

1 Team Factors
- 1.1 Team Structure
  - 1.1.1 Leadership
    - Transactional ☐
    - Transformational ☐
  - 1.2 Team Composition
  - 1.2.1 Individual Traits
    - 1.2.1.1 Personality
      - Agreeableness ☐
      - Conscientiousness ☐
      - Emotional stability ☐
      - Extraversion ☐
      - Openness ☐
    - 1.2.1.2 Cognitive ability
      - General cognitive ability ☐
      - Spatial orientation ☐
      - Verbal comprehension ☐
      - Reasoning ability ☐
  - 1.2.2 Team Diversity
    - Heterogeneous ☐
    - Homogenous ☐

2 Task Factors
- 2.1 Task Type
  - Additive ☐
  - Conjunctive ☐
  - Disjunctive ☐
  - Discretionary ☐
  - Executive ☐
  - Command ☑
  - Negotiation ☐
  - Commissions ☐
  - Advisory ☐
  - Design ☐
- 2.2 Task Characteristics
  - 2.2.1 Task Complexity
    - Scope ☐
    - Structurability ☐
    - Uncertainty ☐
  - 2.2.2 Workload
    - Physical ☐
    - Cognitive ☐
    - Emotional ☐
    - Time pressure ☐
  - 2.2.3 Task Interdependence ☐

3 Team Intervention
- 3.1 Team Training
  - Cross training ☐
  - Team coordination training ☐
  - Team self-correction ☐
  - Assertiveness training ☐
- 3.2 Team Building ☐
- 3.3 Feedback and Goal Setting ☐

4 Team Processes
- 4.1 Shared Knowledge
  - 4.1.1 Mental Models ☐
  - 4.1.2 Situational Awareness ☐
  - 4.1.3 Transactive memory ☐
- 4.2 Communication
  - 4.2.1 Need
    - Communication Frequency ☐
    - Team Structure ☐
  - 4.2.2 Efficiency
    - Anticipation Ratios ☐
    - Team Structure ☐
  - 4.2.3 Technology ☐
  - 4.2.4 Type
    - Implicit vs. Explicit ☐
    - Heterogen vs. Homogen ☐
- 4.3 Team Adaptability
  - 4.3.1 Error Correction ☐
  - 4.3.2 Monitoring ☐
  - 4.3.3 Backing-Up ☐
- 4.4 Planning
  - 4.4.1 Allocation of Resources ☐
    - Personnel ☐
    - Time ☐
    - Material ☐
    - Energy ☐
- 4.5 Coordination
  - Interdependence ☐
  - Team structure ☐
  - Resource allocation ☐
  - Communication ☐
  - Mental Models ☐
- 4.6 Team Climate
  - Morale ☐
  - Motivation ☐
  - Trust ☐
  - Cohesion ☐
  - Collective Efficacy ☐

5 Measures
- 5.1 Outcome
  - Computer ☐
- 5.2 Process
  - Self-Report ☐
  - Observer ☐
- 5.3 Level of Analysis
  - 5.3.1 Individual ☐
  - 5.3.2 Team ☐
  - Collective vs. Holistic ☐

Discussion/Observations
RTOS Models Support both Training-Related Interactive Simulations with Operator Consoles and Analysis-Oriented Simulations using a Non-interaction mode (batch) with an operator model.
Distributed: Simulation Computers and Operator Consoles Netted via Ethernet. External connections to other Distributed Interactive Simulations (DIS) are supported. DIS/HLA Implementation Supports Multiple Battalions and Fire Platoons.

This was rated as somewhat relevant because it is a tactical simulator with no major focus on teams.

Source: http://www.saic.com/products/simulation/rtos/rtos.pdf

Platform Name: Rotocraft Flight Simulation Laboratory
Reference Number: 37
Organization: Boeing
Relevance: Somewhat Relevant
Domain: Air Force

Customized Workstations	☑	Ad Hoc:	No
Communication Channels	☐	Interdisciplinary:	No
Customized Scenarios	☐	Interagency:	No
Platform Type:	Virtual	Joint:	Yes
Fidelity:	Missing info	Distributed:	Yes
Team Size:	Small	Teams of Teams:	No
Primary Purpose:	Training	Level of Activity:	Tactical

Platform Description:
The FSL can simultaneously fly two real-time pilot-in-the-loop simulations autonomously or networked together for air-to-air or formation flying.

Operator/Task Description:
No specific scenarios were identified.

1 Team Factors
- 1.1 Team Structure
  - 1.1.1 Leadership
    - Transactional ☐
    - Transformational ☐
- 1.2 Team Composition
  - 1.2.1 Individual Traits
    - 1.2.1.1 Personality
      - Agreeableness ☐
      - Conscientiousness ☐
      - Emotional stability ☐
      - Extraversion ☐
      - Openness ☐
    - 1.2.1.2 Cognitive ability
      - General cognitive ability ☐
      - Spatial orientation ☐
      - Verbal comprehension ☐
      - Reasoning ability ☐
  - 1.2.2 Team Diversity
    - Heterogeneous ☐
    - Homogenous ☐

2 Task Factors
- 2.1 Task Type
  - Additive ☐
  - Conjunctive ☐
  - Disjunctive ☐
  - Discretionary ☐
  - Executive ☐
  - Command ☐
  - Negotiation ☐
  - Commissions ☐
  - Advisory ☐
  - Design ☐
- 2.2 Task Characteristics
  - 2.2.1 Task Complexity
    - Scope ☐
    - Structurability ☐
    - Uncertainty ☐
  - 2.2.2 Workload
    - Physical ☐
    - Cognitive ☐
    - Emotional ☐
    - Time pressure ☐
  - 2.2.3 Task Interdependence ☐

3 Team Intervention
- 3.1 Team Training
  - Cross training ☐
  - Team coordination training ☐
  - Team self-correction ☐
  - Assertiveness training ☐
- 3.2 Team Building ☐
- 3.3 Feedback and Goal Setting ☐

4 Team Processes
- 4.1 Shared Knowledge
  - 4.1.1 Mental Models ☐
  - 4.1.2 Situational Awareness ☐
  - 4.1.3 Transactive memory ☐
- 4.2 Communication
  - 4.2.1 Need
    - Communication Frequency ☐
    - Team Structure ☐
  - 4.2.2 Efficiency
    - Anticipation Ratios ☐
    - Team Structure ☐
  - 4.2.3 Technology ☐
  - 4.2.4 Type
    - Implicit vs. Explicit ☐
    - Heterogen vs. Homogen ☐
- 4.3 Team Adaptability
  - 4.3.1 Error Correction ☐
  - 4.3.2 Monitoring ☐
  - 4.3.3 Backing-Up ☐
- 4.4 Planning
  - 4.4.1 Allocation of Resources ☐
    - Personnel ☐
    - Time ☐
    - Material ☐
    - Energy ☐
- 4.5 Coordination
  - Interdependence ☐
  - Team structure ☐
  - Resource allocation ☐
  - Communication ☐
  - Mental Models ☐
- 4.6 Team Climate
  - Morale ☐
  - Motivation ☐
  - Trust ☐
  - Cohesion ☐
  - Collective Efficacy ☐

5 Measures
- 5.1 Outcome
  - Computer ☐
- 5.2 Process
  - Self-Report ☐
  - Observer ☐
- 5.3 Level of Analysis
  - 5.3.1 Individual ☐
  - 5.3.2 Team ☐
  - Collective vs. Holistic ☐

Discussion/Observations

Workstations: conducted from individual work stations, each real-time simulation incorporates 30-foot domed visual system with four CRT-based projectors providing a 220-by-125 degree out-of-window field of view.

Not much information was obtained for this platform (not enough info to do mapping).

Source: http://www.boeing.com/phantom/msa/pw_msa.htm

Platform Name: SimTech project, METI
Reference Number: 38
Organization: Swedish Learning Lab and Stanford University
Relevance: Somewhat Relevant
Domain: Medical

Customized Workstations	☐	Ad Hoc:	Capable
Communication Channels	☐	Interdisciplinary:	Yes
Customized Scenarios	☑	Interagency:	No
Platform Type:	Virtual	Joint:	No
Fidelity:	Medium	Distributed:	No
Team Size:	Small	Teams of Teams:	Missing info
Primary Purpose:	Other	Level of Activity:	N/A

Platform Description:
The goal of this project is to examine the use of simulation technologies to reduce the incidence of medical errors through the medical training process. This project aims to develop a 3D World (VR) simulation exercise for team learning in critical care management and to compare it's usefulness with a well-established simulation technology for critical care management—the METI (Medical Education Technologies Inc.) human patient simulator (HPS) system. The METI system includes a human size mannequin, connected to a computer, real OR monitors, and an anaesthesia machine. Cardiac function, breath sounds, oxygen saturation, pupil size and more physiological functions are registered.

Operator/Task Description:
A team consisting of anaesthesiologist, anaesthetist nurse, attending surgeons, technicians etc manage a scenario, and performance is constantly videotaped for a subsequent debriefing.

1 Team Factors
- 1.1 Team Structure
  - 1.1.1 Leadership
    - Transactional ☐
    - Transformational ☐
- 1.2 Team Composition
  - 1.2.1 Individual Traits
    - 1.2.1.1 Personality
      - Agreeableness ☐
      - Conscientiousness ☐
      - Emotional stability ☐
      - Extraversion ☐
      - Openness ☐
    - 1.2.1.2 Cognitive ability
      - General cognitive ability ☐
      - Spatial orientation ☐
      - Verbal comprehension ☐
      - Reasoning ability ☐
  - 1.2.2 Team Diversity
    - Heterogeneous ☐
    - Homogenous ☐

2 Task Factors
- 2.1 Task Type
  - Additive ☐
  - Conjunctive ☐
  - Disjunctive ☐
  - Discretionary ☐
  - Executive ☐
  - Command ☐
  - Negotiation ☐
  - Commissions ☐
  - Advisory ☐
  - Design ☐
- 2.2 Task Characteristics
  - 2.2.1 Task Complexity
    - Scope ☐
    - Structurability ☐
    - Uncertainty ☐
  - 2.2.2 Workload
    - Physical ☐
    - Cognitive ☐
    - Emotional ☐
    - Time pressure ☐
  - 2.2.3 Task Interdependence ☐

3 Team Intervention
- 3.1 Team Training
  - Cross training ☐
  - Team coordination training ☑
  - Team self-correction ☐
  - Assertiveness training ☐
- 3.2 Team Building ☐
- 3.3 Feedback and Goal Setting ☐

4 Team Processes
- 4.1 Shared Knowledge
  - 4.1.1 Mental Models ☑
  - 4.1.2 Situational Awareness ☐
  - 4.1.3 Transactive memory ☐
- 4.2 Communication
  - 4.2.1 Need
    - Communication Frequency ☐
    - Team Structure ☐
  - 4.2.2 Efficiency
    - Anticipation Ratios ☐
    - Team Structure ☐
  - 4.2.3 Technology ☑
  - 4.2.4 Type
    - Implicit vs. Explicit ☐
    - Heterogen vs. Homogen ☐
- 4.3 Team Adaptability
  - 4.3.1 Error Correction ☐
  - 4.3.2 Monitoring ☐
  - 4.3.3 Backing-Up ☐
- 4.4 Planning
  - 4.4.1 Allocation of Resources ☐
    - Personnel ☐
    - Time ☐
    - Material ☐
    - Energy ☐
- 4.5 Coordination
  - Interdependence ☐
  - Team structure ☐
  - Resource allocation ☐
  - Communication ☐
  - Mental Models ☐
- 4.6 Team Climate
  - Morale ☐
  - Motivation ☐
  - Trust ☐
  - Cohesion ☐
  - Collective Efficacy ☐

5 Measures
- 5.1 Outcome
  - Computer ☑
- 5.2 Process
  - Self-Report ☐
  - Observer ☑
- 5.3 Level of Analysis
  - 5.3.1 Individual ☐
  - 5.3.2 Team ☑
  - Collective vs. Holistic ☐

Discussion/Observations
The METI system includes a human size mannequin, connected to a computer, real OR monitors, and an anaesthesia machine. Cardiac function, breath sounds, oxygen saturation, pupil size and more physiological functions are registered.

There are 70 pre-scripted event scenarios (no examples were given).

Sources: http://www.swedishlearninglab.org/swell/projects_index.jsp?id=12 and http://simtech.stanford.edu/ and http://www.meti.com/Product_HPS.html

Platform Name: STRIVE CGF
Reference Number: 39
Organization: CAE
Relevance: Somewhat Relevant
Domain: Air, land, sea, and space

Customized Workstations	☐	Ad Hoc:	Missing info
Communication Channels	☑	Interdisciplinary:	Capable
Customized Scenarios	☑	Interagency:	No
Platform Type:	Constructive and Virtual	Joint:	Capable
Fidelity:	High	Distributed:	Yes
Team Size:	Missing Info	Teams of Teams:	Missing info
Primary Purpose:	Other	Level of Activity:	Tactical

Platform Description:
STRIVE™ CGF is a high fidelity, full function synthetic tactical environment and computer generated forces package. It is CAE's next-generation synthetic tactical environment and computer-generated forces (CGF) package. It is an off-the-shelf software product that simulates a real-time virtual battlefield for air, land, sea, and space applications.

Operator/Task Description:
No specific scenarios were identified. Total scalability in the complexity of models and size of scenarios enables STRIVE-CGF to be used in a variety of applications:
(1) Threat generator for systems integration labs, equipment testbeds, and crew station prototypes (2) CGF for high fidelity, full mission, virtual training (3) CGF for embedded, tactical, desktop, and part task trainers (4) Constructive simulation for operational analysis and research, concept exploration, and doctrine development

1 Team Factors
- 1.1 Team Structure
  - 1.1.1 Leadership
    - Transactional ☐
    - Transformational ☐
- 1.2 Team Composition
  - 1.2.1 Individual Traits
    - 1.2.1.1 Personality
      - Agreeableness ☐
      - Conscientiousness ☐
      - Emotional stability ☐
      - Extraversion ☐
      - Openess ☐
    - 1.2.1.2 Cognative ability
      - General cognative ability ☐
      - Spatial orientation ☐
      - Verbal comprehension ☐
      - Reasoning ability ☐
  - 1.2.2 Team Diversity
    - Heterogenous ☐
    - Homogenous ☐

2 Task Factors
- 2.1 Task Type
  - Additive ☐
  - Conjunctive ☐
  - Disjunctive ☐
  - Discretionary ☐
  - Executive ☐
  - Command ☑
  - Negotiation ☐
  - Commissions ☐
  - Advisory ☐
  - Design ☐
- 2.2 Task Characteristics
  - 2.2.1 Task Complexity
    - Scope ☐
    - Structurability ☐
    - Uncertainty ☐
  - 2.2.2 Workload
    - Physical ☐
    - Cognitive ☐
    - Emotional ☐
    - Time pressure ☐
  - 2.2.3 Task Interdependence ☐

3 Team Intervention
- 3.1 Team Training
  - Cross training ☐
  - Team coordination training ☐
  - Team self-correction ☐
  - Assertiveness training ☐
- 3.2 Team Building ☐
- 3.3 Feedback and Goal Setting ☐

4 Team Processes
- 4.1 Shared Knowledge
  - 4.1.1 Mental Models ☐
  - 4.1.2 Situational Awareness ☐
  - 4.1.3 Transactive memory ☐
- 4.2 Communication
  - 4.2.1 Need
    - Communication Frequency ☐
    - Team Structure ☐
  - 4.2.2 Efficiency
    - Anticipation Ratios ☐
    - Team Structure ☐
  - 4.2.3 Technology ☐
  - 4.2.4 Type
    - Implicit vs. Explicit ☐
    - Heterogen vs. Homogen ☐
- 4.3 Team Adaptability
  - 4.3.1 Error Correction ☐
  - 4.3.2 Monitoring ☐
  - 4.3.3 Backing-Up ☐
- 4.4 Planning
  - 4.4.1 Allocation of Resources ☐
    - Personnel ☐
    - Time ☐
    - Material ☐
    - Energy ☐
- 4.5 Coordination
  - Interdependence ☐
  - Team structure ☐
  - Resource allocation ☐
  - Communication ☐
  - Mental Models ☐
- 4.6 Team Climate
  - Morale ☐
  - Motivation ☐
  - Trust ☐
  - Cohesion ☐
  - Collective Efficacy ☐

5 Measures
- 5.1 Outcome
  - Computer ☑
- 5.2 Process
  - Self-Report ☐
  - Observer ☐
- 5.3 Level of Analysis
  - 5.3.1 Individual ☐
  - 5.3.2 Team ☐
  - Collective vs. Holistic ☐

Discussion/Observations
Distributed: STRIVE-CGF and its underlying layers enable users and third-party developeres to create distributed, reusable, and interoperable simulation components. The distributed architecture enables scalability of scenarios and multiple concurrent users.
Outcome: Digital communications modelling including situation reports, tactical messages and commands.

The STRIVE-CGF includes a comprehensive repository of ready-to-usephysics-based models such as:
- Guidance laws applied to weapon systems to ensure correct trajectories on fly-out
- Radar or electro-optic equations ensure accurate representation of sensor performance
- Dynamics models can take into account actual dynamics data, such as lift and drag tables for aircraft

This platform was rated as only somewhat relevant because there is no major focus on teams and it is primarily a tactical simulation tool.

Source: http://www.cae.com/www2004/Products_and_Services/Military_Simulation_and_Training/Modeling_and_Simulation/Software_and_Support/strive.shtml

Platform Name: Synthesized Immersion Research Environment (SIRE)
Reference Number: 40
Organization: U.S. Air Force Laboratory
Relevance: Somewhat Relevant
Domain: Military General

Customized Workstations	☑	Ad Hoc:	No
Communication Channels	☐	Interdisciplinary:	Capable
Customized Scenarios	☑	Interagency:	No
Platform Type:	Virtual	Joint:	Yes
Fidelity:	Missing Info	Distributed:	Yes
Team Size:	Small	Teams of Teams:	Yes
Primary Purpose:	Other	Level of Activity:	Operational/Tactical

Platform Description:
The SIRE is a general-purpose research environment that can be configured to support applied research regarding the design of advanced human-vehicle interfaces, including aircraft and ground vehicles. One research station within the SIRE includes a 40-foot diameter domed visual presentation and integrated spatial audio presentations and head-mounted displays. The second research station is similar to the first with the a 12-foot cube substituting for the 40-foot dome. Both stations currently incorporate F-16 cockpit shells with advanced in-cockpit display hardware.

Operator/Task Description:
The primary project using this facility at the current time is HEC's Network Centric Operations initiative which uses SIRE as a two-ship human-in-the-loop fighter group performing targeting of time-sensitive and time-critical targets. (No specific details were given of the operator tasks).

1 Team Factors

- 1.1 Team Structure
  - 1.1.1 Leadership
    - Transactional ☐
    - Transformational ☐
- 1.2 Team Composition
  - 1.2.1 Individual Traits
    - 1.2.1.1 Personality
      - Agreeableness ☐
      - Conscientiousness ☐
      - Emotional stability ☐
      - Extraversion ☐
      - Openness ☐
    - 1.2.1.2 Cognitive ability
      - General cognitive ability ☐
      - Spatial orientation ☐
      - Verbal comprehension ☐
      - Reasoning ability ☐
  - 1.2.2 Team Diversity
    - Heterogeneous ☐
    - Homogenous ☐

2 Task Factors

- 2.1 Task Type
  - Additive ☐
  - Conjunctive ☐
  - Disjunctive ☐
  - Discretionary ☐
  - Executive ☐
  - Command ☐
  - Negotiation ☐
  - Commissions ☐
  - Advisory ☐
  - Design ☐
- 2.2 Task Characteristics
  - 2.2.1 Task Complexity
    - Scope ☐
    - Structurability ☐
    - Uncertainty ☐
  - 2.2.2 Workload
    - Physical ☐
    - Cognitive ☐
    - Emotional ☐
    - Time pressure ☑
  - 2.2.3 Task Interdependence ☐

3 Team Intervention

- 3.1 Team Training
  - Cross training ☐
  - Team coordination training ☐
  - Team self-correction ☐
  - Assertiveness training ☐
- 3.2 Team Building ☐
- 3.3 Feedback and Goal Setting ☐

4 Team Processes

- 4.1 Shared Knowledge
  - 4.1.1 Mental Models ☐
  - 4.1.2 Situational Awareness ☐
  - 4.1.3 Transactive memory ☐
- 4.2 Communication
  - 4.2.1 Need
    - Communication Frequency ☐
    - Team Structure ☐
  - 4.2.2 Efficiency
    - Anticipation Ratios ☐
    - Team Structure ☐
  - 4.2.3 Technology ☐
  - 4.2.4 Type
    - Implicit vs. Explicit ☐
    - Heterogen vs. Homogen ☐
- 4.3 Team Adaptability
  - 4.3.1 Error Correction ☐
  - 4.3.2 Monitoring ☐
  - 4.3.3 Backing-Up ☐
- 4.4 Planning
  - 4.4.1 Allocation of Resources ☐
    - Personnel ☐
    - Time ☐
    - Material ☐
    - Energy ☐
- 4.5 Coordination
  - Interdependence ☐
  - Team structure ☐
  - Resource allocation ☐
  - Communication ☐
  - Mental Models ☐
- 4.6 Team Climate
  - Morale ☐
  - Motivation ☐
  - Trust ☐
  - Cohesion ☐
  - Collective Efficacy ☐

5 Measures

- 5.1 Outcome
  - Computer ☐
- 5.2 Process
  - Self-Report ☐
  - Observer ☐
- 5.3 Level of Analysis
  - 5.3.1 Individual ☐
  - 5.3.2 Team ☐
  - Collective vs. Holistic ☐

Discussion/Observations
The Synthesized Immersion Research Environment (SIRE) is a state-of-the-art virtual environment research facility whose **mission is to develop and evaluate advanced, multi-sensory virtual interfaces** for future United States Air Force fighter crew stations.

Not much information could be found on this platform (thus lack of mapping).

Source: http://www.dodsbir.net/sitis/view_pdf.asp?id=SAFIRE%20facilities.doc

Platform Name: TEAMSim (Team Event-Based Adaptive Multilevel Simulation)
Reference Number: 41
Organization: Missing Info
Relevance: Somewhat Relevant
Domain: Radar

Customized Workstations	☐	Ad Hoc:	Capable
Communication Channels	☑	Interdisciplinary:	Yes
Customized Scenarios	☑	Interagency:	No
Platform Type:	Virtual	Joint:	No
Fidelity:	Low	Distributed:	Missing info
Team Size:	Small	Teams of Teams:	Missing info
Primary Purpose:	Team Experiments	Level of Activity:	Operational/Tactical

Platform Description:
TEAMSim is a PC-based simulation of a radar-tracking task. Three-person teams were seated at simulated radar consoles where contacts with different priorities and patterns of movement appeared.

Operator/Task Description:
Participants needed to learn how to "hook" contacts on the radar screen, collect information to classify their characteristics, and render an overall decision (take action or clear) for each contact. Each team member was primarily responsible for one of three sectors designated on the display, but each had discretion to monitor and work in their teammates' sectors.

1 Team Factors

- 1.1 Team Structure
  - 1.1.1 Leadership
    - Transactional ☐
    - Transformational ☐
- 1.2 Team Composition
  - 1.2.1 Individual Traits
    - 1.2.1.1 Personality
      - Agreeableness ☐
      - Conscientiousness ☐
      - Emotional stability ☐
      - Extraversion ☐
      - Openness ☐
    - 1.2.1.2 Cognitive ability
      - General cognitive ability ☐
      - Spatial orientation ☑
      - Verbal comprehension ☐
      - Reasoning ability ☐
  - 1.2.2 Team Diversity
    - Heterogeneous ☑
    - Homogenous ☐

2 Task Factors

- 2.1 Task Type
  - Additive ☑
  - Conjunctive ☐
  - Disjunctive ☐
  - Discretionary ☑
  - Executive ☐
  - Command ☐
  - Negotiation ☐
  - Commissions ☐
  - Advisory ☐
  - Design ☐
- 2.2 Task Characteristics
  - 2.2.1 Task Complexity
    - Scope ☐
    - Structurability ☐
    - Uncertainty ☐
  - 2.2.2 Workload
    - Physical ☐
    - Cognitive ☑
    - Emotional ☐
    - Time pressure ☐
  - 2.2.3 Task Interdependence ☑

3 Team Intervention

- 3.1 Team Training
  - Cross training ☐
  - Team coordination training ☐
  - Team self-correction ☐
  - Assertiveness training ☐
- 3.2 Team Building ☐
- 3.3 Feedback and Goal Setting ☐

4 Team Processes

- 4.1 Shared Knowledge
  - 4.1.1 Mental Models ☐
  - 4.1.2 Situational Awareness ☐
  - 4.1.3 Transactive memory ☐
- 4.2 Communication
  - 4.2.1 Need
    - Communication Frequency ☐
    - Team Structure ☐
  - 4.2.2 Efficiency
    - Anticipation Ratios ☐
    - Team Structure ☐
  - 4.2.3 Technology ☐
  - 4.2.4 Type
    - Implicit vs. Explicit ☐
    - Heterogen vs. Homogen ☐
- 4.3 Team Adaptability
  - 4.3.1 Error Correction ☐
  - 4.3.2 Monitoring ☐
  - 4.3.3 Backing-Up ☐
- 4.4 Planning
  - 4.4.1 Allocation of Resources ☐
    - Personnel ☐
    - Time ☐
    - Material ☐
    - Energy ☐
- 4.5 Coordination
  - Interdependence ☐
  - Team structure ☐
  - Resource allocation ☑
  - Communication ☐
  - Mental Models ☐
- 4.6 Team Climate
  - Morale ☐
  - Motivation ☐
  - Trust ☐
  - Cohesion ☐
  - Collective Efficacy ☐

5 Measures

- 5.1 Outcome
  - Computer ☐
- 5.2 Process
  - Self-Report ☐
  - Observer ☐
- 5.3 Level of Analysis
  - 5.3.1 Individual ☐
  - 5.3.2 Team ☐
  - Collective vs. Holistic ☐

Discussion/Observations
From the article, "A Multilevel Model of Feedback Effects on the Regulation of Individual and Team Performance," (DeShon, Kozlowski, Schmidt, Milner, Wiechmann, 2004) Interdependence created discretionary opportunities for other members to shift their priorities and strategies, coordinate effort, and contribute to team performance. Unpredictable but systematic overloading of team members was designed to prompt resource allocation.

Note: the mapping was conducted considering the objective of the study.

Source: Article "A Multiple-Goal, Multilevel Model of Feedback Effects on the Regulation of Individual and Team Performance," DeSHON, R.P., KOZLOWSKI, S.W.J., SCHMIDT, A.M., MILNER, K.R., WIECHMANN, D., 2004

Platform Name: The Archimedes Combat Modelling Platform
Reference Number: 42
Organization: Least Squares Software LCC
Relevance: Somewhat Relevant
Domain: Military General

Customized Workstations	☐	Ad Hoc:	No
Communication Channels	☐	Interdisciplinary:	No
Customized Scenarios	☑		
		Interagency:	No
Platform Type:	Constructive	Joint:	No
Fidelity:	Scalable fidelity	Distributed:	No
Team Size:	Small	Teams of Teams:	Yes
Primary Purpose:	Team Experiments	Level of Activity:	Operational/Tactical

Platform Description:
The Archimedes Combat Modeling Platform is a simulator system based on ideas developed from research into the behavior of complex systems. The goals of Archimedes, and more broadly of its sponsor, The United States Marine Corps Combat Development Commands' Project Albert, is that it be able to represent the intangibles of combat and that it capture the nonlinearity intrinsic to battlefield situations. Intangibles include the roles of discipline, cohesion, morale and personality. Archimedes is based on the paradigm of Agent based modeling (ABM). This approach breaks a problem down into constituent elements, called Agents. Archimedes is based on a general high-level ABM software framework called the Behaviour Action Simulation Platform (BASP). Agents are autonomous software units that work independently towards some goal (which may involve cooperating with other Agents). Guided by the ideas of operational synthesis, Archimedes was designed first to be as flexible as possible in order to represent a broad variety of missions.

Operator/Task Description:
Example of a reconnaissance scenario: The (very simple) playbox consists of a 10x10 grid, each element on the grid represents a distinct terrain element. Each terrain element is characterized by three quantities: trafficability, which affects movement; cover, which affects combat adjudication; and concealment, which affects detection. In this scenario, a recon team (blue Agents) traverses a series of recon checkpoints black Agents), searching for an objective (turquoise Agent) that is under guard by the enemy (red Agents). The blue Agents' goal is to locate the objective without being detected by the red Agents. The blue Agents are endowed with behaviours designed by the analyst (programmer) to enable them to achieve their goal. These behaviours are dependent upon an Agent Variable, discipline.

1 Team Factors
- 1.1 Team Structure
  - 1.1.1 Leadership
    - Transactional ☐
    - Transformational ☐
  - 1.2 Team Composition
    - 1.2.1 Individual Traits
      - 1.2.1.1 Personality
        - Agreeableness ☐
        - Conscientiousness ☐
        - Emotional stability ☐
        - Extraversion ☐
        - Openness ☐
      - 1.2.1.2 Cognitive ability
        - General cognitive ability ☐
        - Spatial orientation ☐
        - Verbal comprehension ☐
        - Reasoning ability ☐
      - 1.2.2 Team Diversity
        - Heterogeneous ☑
        - Homogenous ☑

2 Task Factors
- 2.1 Task Type
  - Additive ☐
  - Conjunctive ☐
  - Disjunctive ☐
  - Discretionary ☐
  - Executive ☐
  - Command ☐
  - Negotiation ☐
  - Commissions ☐
  - Advisory ☐
  - Design ☐
- 2.2 Task Characteristics
  - 2.2.1 Task Complexity
    - Scope ☐
    - Structurability ☐
    - Uncertainty ☐
  - 2.2.2 Workload
    - Physical ☐
    - Cognitive ☐
    - Emotional ☐
    - Time pressure ☐
  - 2.2.3 Task Interdependence ☐

3 Team Intervention
- 3.1 Team Training
  - Cross training ☐
  - Team coordination training ☐
  - Team self-correction ☐
  - Assertiveness training ☐
- 3.2 Team Building ☐
- 3.3 Feedback and Goal Setting ☐

4 Team Processes
- 4.1 Shared Knowledge
  - 4.1.1 Mental Models ☐
  - 4.1.2 Situational Awareness ☐
  - 4.1.3 Transactive memory ☐
- 4.2 Communication
  - 4.2.1 Need
    - Communication Frequency ☐
    - Team Structure ☐
  - 4.2.2 Efficiency
    - Anticipation Ratios ☐
    - Team Structure ☐
  - 4.2.3 Technology ☐
  - 4.2.4 Type
    - Implicit vs. Explicit ☐
    - Heterogen vs. Homogen ☐
- 4.3 Team Adaptability
  - 4.3.1 Error Correction ☐
  - 4.3.2 Monitoring ☐
  - 4.3.3 Backing-Up ☐
- 4.4 Planning
  - 4.4.1 Allocation of Resources ☐
    - Personnel ☐
    - Time ☐
    - Material ☐
    - Energy ☐
- 4.5 Coordination
  - Interdependence ☐
  - Team structure ☐
  - Resource allocation ☐
  - Communication ☐
  - Mental Models ☐
- 4.6 Team Climate
  - Morale ☑
  - Motivation ☐
  - Trust ☐
  - Cohesion ☑
  - Collective Efficacy ☐

5 Measures
- 5.1 Outcome
  - Computer ☑
- 5.2 Process
  - Self-Report ☑
  - Observer ☐
- 5.3 Level of Analysis
  - 5.3.1 Individual ☐
  - 5.3.2 Team ☐
  - Collective vs. Holistic ☐

Discussion/Observations
Agents may represent individuals or units of any size, including heterogeneous collections.

The behavioural specification is extremely flexible and modular – an analyst may specify behaviours for Agents, and for the interactions between Agents (e.g. "IF attitude towards non-combatants IS friendly THEN attitude towards militia IS neutral. END IF"). Analysts are free to define virtually any behaviour of their own devising.

Details were given on the logic of this platform software. This platform will be examined again in Task 3: Tool Evaluation.

Source: http://www.leastsquares.com/papers/mws2001.pdf

Platform Name: The Cirrus Mine Hunting Simulation System (MHSS)
Reference Number: 43
Organization: Australian Department of Defence
Relevance: Somewhat Relevant
Domain: Mine Hunting

Customized Workstations	☑	Ad Hoc:	Capable
Communication Channels	☐	Interdisciplinary:	No
Customized Scenarios	☐	Interagency:	No
Platform Type:		Joint:	No
Fidelity:	High	Distributed:	No
Team Size:	Small	Teams of Teams:	Yes
Primary Purpose:	Training	Level of Activity:	Tactical

Platform Description:
The Cirrus Mine Hunting Simulation System (MHSS) has been developed in close cooperation with the Royal Australian Navy to provide cost effective simulation training in mine hunting.

Emulation of sonar consoles supports basic familiarisation of students in the control of their ship-fit minehunting sonar and associated tactical data management system. The training network of 10 consoles facilitates the bulk training of personnel.

Operator/Task Description:
No specific scenarios were identified. There are packaged scenarios available with 3 levels of difficulty to progressively introduce trainees to mine hunting challenges.

1 Team Factors

- 1.1 Team Structure
  - 1.1.1 Leadership
    - Transactional ☐
    - Transformational ☐
- 1.2 Team Composition
  - 1.2.1 Individual Traits
    - 1.2.1.1 Personality
      - Agreeableness ☐
      - Conscientiousness ☐
      - Emotional stability ☐
      - Extraversion ☐
      - Openness ☐
    - 1.2.1.2 Cognitive ability
      - General cognitive ability ☐
      - Spatial orientation ☐
      - Verbal comprehension ☐
      - Reasoning ability ☐
  - 1.2.2 Team Diversity
    - Heterogeneous ☐
    - Homogenous ☐

2 Task Factors

- 2.1 Task Type
  - Additive ☐
  - Conjunctive ☐
  - Disjunctive ☐
  - Discretionary ☐
  - Executive ☐
  - Command ☑
  - Negotiation ☐
  - Commissions ☐
  - Advisory ☐
  - Design ☐
- 2.2 Task Characteristics
  - 2.2.1 Task Complexity
    - Scope ☐
    - Structurability ☐
    - Uncertainty ☐
  - 2.2.2 Workload
    - Physical ☑
    - Cognitive ☑
    - Emotional ☐
    - Time pressure ☐
  - 2.2.3 Task Interdependence ☐

3 Team Intervention

- 3.1 Team Training
  - Cross training ☐
  - Team coordination training ☑
  - Team self-correction ☐
  - Assertiveness training ☐
- 3.2 Team Building ☐
- 3.3 Feedback and Goal Setting ☐

4 Team Processes

- 4.1 Shared Knowledge
  - 4.1.1 Mental Models ☐
  - 4.1.2 Situational Awareness ☐
  - 4.1.3 Transactive memory ☐
- 4.2 Communication
  - 4.2.1 Need
    - Communication Frequency ☐
    - Team Structure ☐
  - 4.2.2 Efficiency
    - Anticipation Ratios ☐
    - Team Structure ☐
  - 4.2.3 Technology ☐
  - 4.2.4 Type
    - Implicit vs. Explicit ☐
    - Heterogen vs. Homogen ☐
- 4.3 Team Adaptability
  - 4.3.1 Error Correction ☐
  - 4.3.2 Monitoring ☐
  - 4.3.3 Backing-Up ☐
- 4.4 Planning
  - 4.4.1 Allocation of Resources ☐
    - Personnel ☐
    - Time ☐
    - Material ☐
    - Energy ☐
- 4.5 Coordination
  - Interdependence ☐
  - Team structure ☐
  - Resource allocation ☐
  - Communication ☐
  - Mental Models ☐
- 4.6 Team Climate
  - Morale ☐
  - Motivation ☐
  - Trust ☐
  - Cohesion ☐
  - Collective Efficacy ☐

5 Measures

- 5.1 Outcome
  - Computer ☑
- 5.2 Process
  - Self-Report ☐
  - Observer ☑
- 5.3 Level of Analysis
  - 5.3.1 Individual ☑
  - 5.3.2 Team ☑
  - Collective vs. Holistic ☐

Discussion/Observations
This is a high fidelity simulator, with high performance sonar image emulation engine that drives the simulation. Characteristics of the sea bed, the contacts, the environment, the sensor and operator controls are all realistically simulated, maximizing trainee understanding of mine-hunting acoustics.

Instructors can easily monitor trainees progress. There was no specific description for team tasks only a statement that there is 3x3 mode, for command team training.

Source: http://www.defence.gov.au/teamaustralia/indexb53c.html and http://www.cirrusrtps.com.au/Cirrus%20MHSS.pdf

Platform Name: TRIDENT Command and Control Team Trainer
Reference Number: 44
Organization: NAVAIR Orlando Training Systems Division
Relevance: Somewhat Relevant
Domain: Command and Control

Customized Workstations	☑	Ad Hoc:	Capable
Communication Channels	☐	Interdisciplinary:	Yes
Customized Scenarios	☑	Interagency:	No
Platform Type:	Virtual	Joint:	No
Fidelity:	High	Distributed:	Capable
Team Size:	Missing Info	Teams of Teams:	Yes
Primary Purpose:	Training	Level of Activity:	Operational

Platform Description:
The CCTT enhances the attack center team's ability to perform the TRIDENT's mission. The CCTT replicates major physical structures of the TRIDENT control room including the periscope platform, ship control station, AN/WLR-8(V)5, and various plotter tables.

Operator/Task Description:
Realistic simulated scenarios provide immediate feedback on performance. EADSIM is used by operational commanders, trainers, and analysts to model the performance and predict the effectiveness of ballistic missiles, surface-to-air missiles, aircraft, and cruise missiles in a variety of user-developed scenarios.

1 Team Factors

- 1.1 Team Structure
  - 1.1.1 Leadership
    - Transactional ☐
    - Transformational ☐
- 1.2 Team Composition
  - 1.2.1 Individual Traits
    - 1.2.1.1 Personality
      - Agreeableness ☐
      - Conscientiousness ☐
      - Emotional stability ☐
      - Extraversion ☐
      - Openness ☐
    - 1.2.1.2 Cognitive ability
      - General cognitive ability ☑
      - Spatial orientation ☐
      - Verbal comprehension ☐
      - Reasoning ability ☐
  - 1.2.2 Team Diversity
    - Heterogeneous ☐
    - Homogenous ☐

2 Task Factors

- 2.1 Task Type
  - Additive ☐
  - Conjunctive ☐
  - Disjunctive ☐
  - Discretionary ☐
  - Executive ☐
  - Command ☐
  - Negotiation ☐
  - Commissions ☐
  - Advisory ☐
  - Design ☐
- 2.2 Task Characteristics
  - 2.2.1 Task Complexity
    - Scope ☐
    - Structurability ☐
    - Uncertainty ☐
  - 2.2.2 Workload
    - Physical ☐
    - Cognitive ☐
    - Emotional ☐
    - Time pressure ☐
  - 2.2.3 Task Interdependence ☐

3 Team Intervention

- 3.1 Team Training
  - Cross training ☐
  - Team coordination training ☐
  - Team self-correction ☐
  - Assertiveness training ☐
- 3.2 Team Building ☐
- 3.3 Feedback and Goal Setting ☐

4 Team Processes

- 4.1 Shared Knowledge
  - 4.1.1 Mental Models ☑
  - 4.1.2 Situational Awareness ☑
  - 4.1.3 Transactive memory ☐
- 4.2 Communication
  - 4.2.1 Need
    - Communication Frequency ☐
    - Team Structure ☐
  - 4.2.2 Efficiency
    - Anticipation Ratios ☐
    - Team Structure ☐
  - 4.2.3 Technology ☐
  - 4.2.4 Type
    - Implicit vs. Explicit ☐
    - Heterogen vs. Homogen ☐
- 4.3 Team Adaptability
  - 4.3.1 Error Correction ☐
  - 4.3.2 Monitoring ☐
  - 4.3.3 Backing-Up ☐
- 4.4 Planning
  - 4.4.1 Allocation of Resources ☐
    - Personnel ☐
    - Time ☐
    - Material ☐
    - Energy ☐
- 4.5 Coordination
  - Interdependence ☐
  - Team structure ☐
  - Resource allocation ☐
  - Communication ☐
  - Mental Models ☐
- 4.6 Team Climate
  - Morale ☐
  - Motivation ☐
  - Trust ☐
  - Cohesion ☐
  - Collective Efficacy ☐

5 Measures

- 5.1 Outcome
  - Computer ☑
- 5.2 Process
  - Self-Report ☐
  - Observer ☐
- 5.3 Level of Analysis
  - 5.3.1 Individual ☐
  - 5.3.2 Team ☐
  - Collective vs. Holistic ☐

Discussion/Observations

Not much information was provided for this platform (thus the lack of mapping).

Source: http://www.ntsc.navy.mil/Programs/TrainerDescriptions/UnderseaPrograms/TridentCommandControl.cfm

Annex B:
Platform Search Table

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Ref #	Domain	Platform	Organization	Category	Description	Relevance	Primary Purpose for Team Research	Ad Hoc	Interdisciplinary	Interagency	Joint	Distributed	Teams of Teams	Size of Team
1	Command and Control	AEDGE	U.S. Air Force Research Laboratory	Constructive and Virtual	The AEDGE was developed based on cognitive and functional analysis of C3 mission, tactics, team member roles, and role interdependencies. The behavior and decision making of all hostile and friendly entities not controlled by humans is directed by agent-based technology. If a human decides to "log in" as a particular entity, he/she may choose to view recommendations generated by the agent for that entity. Even if the human operator chooses not to view recommendations, the agent recommendations are still logged by the computer. This enables direct comparison of human to agent decisionmaking.	Highly Relevant	Yes	Capable	Yes	No	Yes	Yes	Yes	Medium
2	Air Force	Air Operations Center (AOC) Strategy Visualization Tools	U.S. Air Force Research Laboratory	Virtual and Constructive	Air Operations Centers (AOC) are pivotal to planning, control, and execution of an aerospace campaign. They are the nerve centers, the command and control nodes, for theater aerospace combat power. In wartime, these highly complex organizations deal with staggering amounts of information - often more than can be processed. The purpose of this program is to create innovative work support systems to improve decision-making within the AOC. The idea is to allow decisions to be made and plans to be formulated more quickly by providing users with intuitive, high-level visualizations of mission effects, interrelationships and mechanisms. The end result will be improved planning and assessment within the air tasking order (ATO) cycle.	Highly Relevant	No, development of work support systems to support decision making in AOCs	Yes	Yes	Yes	Yes	Yes	Yes	Large
3	Air Force	AWACS in the C3STARS Facility	U.S. Air Force Research Laboratory (Mesa, Arizona)	Virtual	The Command, Control, and Communications Simulation, Training, and Research System (C3STARS) facility offers the opportunity to investigate complex decision making among interdependent team members within a dynamic and realistic setting. The crew stations and scenarios simulate the air defence mission of an Airborne Warning and Control System (AWACS) platform. Realism is achieved through the functional representation of equipment and displays, experienced personnel playing the role of simulation pilots, and the use of operational scenarios.	Highly Relevant	Yes	Capable	Capable	No	Yes	Yes	No	Small
4	Command and Control	Distributed Dynamic Decision Making	Aptima	Virtual	The DDD is a unique distributed multi-person simulation and software tool for understanding how high-performance teams operate in complex environments	Highly Relevant	Yes	Capable	Yes	Yes	Yes	Yes	No	Small
5	Space	NASA Ames Centre-Distributed Research Facilities	NASA	Virtual	Teams composed of four or five members engage in an Antarctic or Mars search mission over a period of four days (one day of training, three days involving six simulations). Team and task stressors are manipulated along with team composition (gender and national culture). Time synchronized data (computer-based task performance, physiological measures, audio and video recordings) support analyses of team processes and outcomes, including responses to task and interpersonal stress. Questionnaire data (workload, team dynamics and individual difference measures, e.g., personality and cognitive processes) provide essential information concerning team composition, leadership and performance both at the individual and team levels.	Highly Relevant	Yes	Capable	Capable	Capable	No	Capable	No	Small
6	Emergency Services	NeoCities	Pennsylvania State University and Purdue University	Virtual	The NeoCITIES simulation was created to study decision-making and the impact of hidden knowledge profiles on team performance within a distributed command, control, and communications (C3) setting. NeoCITIES has been designed for the purpose of representing both new and operationally relevant scaled worlds, while emulating the complexities and attributes of emergent decision-making scenarios involving emergent counterterrorism events.	Highly Relevant	Yes, decision making and impact of hidden knowledge on team performance	Capable	Yes	Yes	No	Yes	Yes	Small
7	Military General	One Semi-Automated Forces (OneSAF)	US Army	Virtual and Constructive	OneSAF, as a PC-based or laptop training system, will ultimately be fielded to every battalion in the Army. It will ultimately be deployed to all active duty brigades and battalions, Army schools, labs and engineering centers, National Guard and Army Reserve units. The system is supposed to simulate specific activities of ground warfare, specifically engagement and maneuver. It will include Command, Control, Communications, Computers and Intelligence (C4I) as well as combat support. Using a detailed terrain database, OneSAF will employ highly realistic representations of the physical environment where soldier movements and behaviors can be reproduced to enhance training value.	Highly Relevant	No, C2 training	Capable	Yes	No	Yes	Yes	Yes	Scaleable
8	Army	Tactical Simulation System - TACSIM	US Army	Virtual	The Tactical Simulation System (TACSIM) is the Army's leading intelligence collection and dissemination model. In near-real time, TACSIM aids in the training of Intelligence Analysts, Collection Managers, and staffs for the design of collection requirements and the analysis of raw intelligence. TACSIM uses interactive computer-based simulation to support intelligence training from MI Battalion through Echelons Above Corps in exercises such as REFORGER, Central Fortress, Ulchi Focus Lens, Team Spirit, Warfighter, and others across Germany, Korea, and the United States.	Highly Relevant	No, intelligence training	Capable	Yes	Yes	Yes	Yes	Yes	Medium
9	Command and Control	Virtual Warfare Center	Boeing	Virtual	State-of-the art customer center allows military experts to analyze and take part in simulated battle scenarios in order to develop future systems and platforms.	Highly Relevant	Yes	Capable	Yes	Yes	Yes	Yes	Yes	Large
10	Emergency Services	Advanced Disaster Management Simulator - ADAMS	Environmental Tectonics Corporation (ETC)	Virtual	The Advanced Disaster Management Simulator (ADMS™) is an interactive virtual reality-based team training system that provides emergency responders an opportunity to develop skills in emergency response. ADMS simultaneously trains incident commanders and team leaders in disaster management skills, and allows trainees to rehearse and retain the four C's of disaster management: Command, Control Coordination and Communication. ADMS simulates emergency incidents such as aircraft accidents, terrorist acts, Weapons of Mass Destruction, hazardous material spills, airfield incursions, multi-vehicle road accidents, fires and natural disasters for the purposes of planning, training, testing and validating.	Relevant	No, EMS Training	No	Yes	Yes	No	Yes	Missing Info	Medium

Ref #	Domain	Platform	Organization	Category	Description	Relevance	Primary Purpose for Team Research	Ad Hoc	Interdisciplinary	Interagency	Joint	Distributed	Teams of Teams	Size of Team
11	Air Force	Air Defence Synthetic Environment (ADSE)	UK DAES MOD SIM	Virtual	The primary goal of ADSE was the development of a validated set of networked simulation assets representing current and future ground based Air Defence (AD) systems and associated environment.	Relevant	No, prototype current and future system requirements	No	Yes	No	Yes	Yes	No	Small
12	Air Traffic Control	Aviation Research and Training Tools (ARTT)	Adecel Technologies, Australian Department of Defence	Virtual	Adacel's Advanced Air Traffic Control simulation systems are used throughout the world for training civil and military air traffic controllers and for research on airport traffic procedures and processes. The range of tools includes tower and radar simulators, as well as a driver simulator for airport driver training.	Relevant	No, Team training and assessment	No	Yes	Yes	Yes	Yes	Yes	Medium
13	Command and Control	Cognitive Engineering Research on Team Tasks (CERTT)	Arizona State University	Virtual	CERTT's mission is to understand and measure team cognition in socio-techinical systems. Our simulation of a three-person Uninhabited Air Vehicle (UAV) ground control task provides a context in which to study socio-technical systems.	Relevant	Yes	No	Yes	No	No	Capable	No	Small
14	Command and Control	Combined Arms Tactical Trainer (CATT)	United Kingdom	Constructive and Virtual	CATT is the largest and most sophisticated virtual training facility in the world and because of this has gained a listing in the, "Guinness Book of Records". The simulators are housed in a building the size of two football pitches in Warminster which, in turn, is able to be linked in real-time to a sister facility in Germany.	Relevant	Yes, military training	No	Yes	No	Yes	Yes	Yes	Large
15	Army, National Guard, and US Army Reserve	Corps Battle Simulation (CBS)	US Army PEO STRI (Program Executive Office for Simulation, Training, & Instrumentation)	Virtual	CBS is a geographically and functionally distributed air/land warfare simulation that drives the U.S. Army Battle Command Training Program's (BCTP) War Fighter Exercises as well as Corps and Division command post training exercises for the active Army, National Guard, and the US Army Reserve. The CBS simulation also serves as the Land Warfare component of various Joint Training Exercises as a member of the Joint Training Confederation (JTC). CBS provides training stimuli for all ground forces staff elements from Brigade to Corps including combat, combat support, combat service support, and fixed and rotary wing air operations.	Relevant	No, training for army	Capable	Yes	Yes	Yes	Capable	No	Scaleable
16	Command and Control	GESI - Gefechts Simulationssystem	CAE	Virtual	GESI Command and Staff Training System is based on a constructive simulation model and provides combined arms combat and OOTW exercises from company up to division levels. The commanders determine the course of the simulation exercise by the decisions they make and are immediately confronted with the results of their actions.	Relevant	Miltary Training	Capable	Yes	No	Yes	Yes	Yes	Medium
17	Command and Control	Joint Theatre Level Simulation	United States Department of Defence	Virtual	Joint Theatre Level Simulation (JTLS), an interactive, computer-assisted simulation tool used in joint training programs, focuses on the operational level of war as experienced by the regional combatant commanders and joint task force staffs.	Relevant	No, Simulation tool for Joint training	Capable	Yes	No	Yes	Yes	Capable	Scaleable
18	Military General	Marine Corps Air Ground Task Force (MAGTF) Marine Tactical Warfare Simulation (MTWS)	Marine Corps	Constructive and Virtual	The Marine Air Ground Task Force (MAGTF) Tactical Warfare Simulation (MTWS) is a computer-assisted exercise support tool designed to support Marine Corps commanders and their staffs. MTWS is used in Command Post Exercises (CPX), in which combat forces, supporting arms, and results of combat are modeled by the system. MTWS can be used to plan tactical operations, evaluate a plan under alternative enemy or environmental conditions, and as an experimental tool to assess decision making.	Relevant	No, MTWS used to plan tactical ops, evaluate plans, and as an experimental tool to assess decision making.	Capable	Yes	No	Yes	Capable	Capable	Medium
19	Command and Control	Tactical Navy Decision Making System - TANDEM	Navel Systems Training Centre, Orlando	Virtual	TANDEM (1992) was designed to be a more ecologically valid simulation of a command, control, and communication environment; rather than use synthetic work it employs tasks that are closer to the real- life counterpart of a combat information centre. Decision- making skills require information-sharing among one to three participants, as decisions must be made based on provided information regarding unknown contacts. Task characteristics such as interdependence, time pressure, and work load can be examined, and the scenario is reconfigurable. However, TANDEM does not require the integration of new or changing information over time; participants are equipped with the same knowledge set for the duration of the session.	Relevant	No, primarily used for research	Yes	Yes	No	Yes	Capable	Yes	Small
20	Command and Control	TITAN (Team and Individual Tactical Assessment Network)	DRDC Toronto, Team Decision Making and C2 Facility	Virtual	T.I.T.A.N. (Team and Individual Tactical Assessment Network) is a low-fidelity defence simulator designed by NTT Systems Inc. (www.ntt.ca) to test the effects of decision support aids on decision-making processes. It is a highly flexible and configurable theory-based simulator. TITAN can be run in both standalone (solo) and networked (team) platforms. The networked platform is played with an all human team or a combined team of human and automated agents. Automated agents are computer-generated players that can be programmed by the experimenter to display specific response patterns (e.g., response bias or error, delayed response). Several features of the simulator interface and task parameters can also be customized by the experimenter to accommodate a specific experimental design or method. Networked TITAN offers the potential for multiple players from different geographic locations to participate in the same TITAN session simultaneously in real time via the Internet.	Relevant	No, for decision making	Capable	Capable	Capable	Yes	Capable	Capable	Scaleable

Ref #	Domain	Platform	Organization	Category	Description	Relevance	Primary Purpose for Team Research	Ad Hoc	Interdisciplinary	Interagency	Joint	Distributed	Teams of Teams	Size of Team
21	Army	Warfigher's Simulation (WARSIM)	US Army PEO STRI (Program Executive Office for Simulation, Training, & Instrumentation)	Virtual and Constructive	WARSIM is an aggregate and distributed constructive wargaming simulation designed to create an integrated synthetic battlespace, replicating a Contemporary Operational Environment (COE) and populating the common operational picture. WARSIM Interfaces with Commanders and Staff organic Command and Control (C2) equipment to create a training environment indistinguishable from the real world by the training audience. WARSIM is a training device used to train Army Commanders and their Staffs at the Brigade and higher echelons in Army Warfighters and Mission Rehearsal Excercises. WARSIM includes an intelligence subcomponent, formally known as WIM, which has been fully integrated within the WARSIM system.	Relevant	No, training for army	Yes	Yes	Capable	Yes	Yes	Yes	Scaleable
22	Military General	Abrams Full Crew Interactive Skills Trainer (AFIST)	United States Department of Defence	Virtual	The AFIST is an appended tank gunnery training device for use on a powerless, stationary, sheltered, M1 or M1A1 tank. With AFIST, M1 and M1A1 tank crews can conduct tank gunnery training using the actual controls and input devices of the tank.	Somewhat Relevant	No, Training	No	Yes	No	Yes	Yes	Yes	Small
23	Naval	Anti-Submarine Warfare Team Trainer	RHEINMETALL DEFENCE ELECTRONICS, Denmark	Virtual	The ASW Team Trainer realisitcally simulates tactical situations and sea environments for ASW command and control operations. Images present trainees with ultra-realistic impressions of motion, geometry and position, relative to navigation marks, coastal terrains and other vessels.	Somewhat Relevant	No, Team training and assessment	No	No	No	No	No	No	Small
24	Air	Battle Management Command and Control (BMC2)	U.S. Air Force Research Lab - Decision-Making and Automation Research Testbed DART Lab	Virtual	The BMC2 lab has the capability to portray high degree of realism while maintaining a suitable degree of experimental control. The BMC2 lab (formerly known as the Multi-sensory Overview Large-scale Tactical Knowledge Environment (MOLTKE) lab) is a medium-fidelity simulation of an Airborne Warning And Control System (AWACS) environment. The laboratory consists of six workstations arranged in two rows of three facing each other, similar to a console arrangement on the AWACS E-3 aircraft.	Somewhat Relevant	No, test readiness of ABM technologies	No	No	No	No	Capable	No	Small
25	Tank	BOLO: The multi-player battle game	Computer shareware	Virtual	Computer-simulated tank exercise. Team members play on computers and each control on-screen tank.	Somewhat Relevant	No, Computer Game	Capable	No	No	No	Yes	No	Small
26	Air	Comanche 2.0, 1995 Navy helicopter - PC based helicopter flight simulation	Novalogic	Virtual	PC-based helicopter flight and combat simulator.	Somewhat Relevant	No, video game	Yes	Yes	No	No	No	Missing info	Small
27	Naval	Dangerous Waters	Sonalysts Combat Simulations	Virtual	Dangerous Waters simulates an Oliver Hazard Perry Class Guided Missile Fast Frigate, its MH-60R multi-mission helicopter or a P-3C Orion ASW/ASUW aircraft. The platform also simulates the U.S. Seawolf or Improved Los Angeles Class Nuclear Submarine, Russian Akula I Improved or Akula II Nuclear Submarine or an ultra quiet Russian or Chinese Kilo diesel sub. The Multiplayer Multi-Station mode allows players to man a specific station aboard a ship, plane or sub with other players taking the role of other crewmembers on the same platform.	Somewhat Relevant	No, video game	Yes	Capable	NA	Yes	Yes	Yes	Scaleable
28	Command and Control	Extended Air Defense Simulation	Air Force Materiel Command	Constructive	EADSIM is used for scenarios ranging from few-on-few to many-on-many. It represents all the missions on both sides. It individually models each platform (such as a fighter aircraft) and the interaction among such platforms. It models the Command and Control (C2) decision processes and the communications among the platforms on a message-by-message basis. Intelligence, surveillance, and reconnaissance are explicitly modeled to support offensive and defensive applications.	Somewhat Relevant	No, Defense Training	Capable	Yes	Capable	Yes	Yes	Yes	Medium
29	Air Traffic Control	FIRSTplus Radar ATC Simulator	Raytheon	Virtual	The FIRSTplus™ Radar ATC Simulator provides a complete range of modern, operationally accurate and advanced ATC (Air Traffic Control) training systems, supporting enroute, terminal and towercontrol operations for both civil and military users. FIRSTplus™ addresses all levels of training, including ab-initio certification, re-certification and refresher, emergency and conversion courses, as well as R/T phraseology training and self-teach classroom evaluations	Somewhat Relevant	No, ATC training for ab-initio certification, refresher, emergency and conversion courses, R/T phraseology training	Capable	Yes	Yes	Yes	Capable	No	Scaleable
30	Air	Flight Simulator, Falcon 3.0, 1991	Spectrum Holobyte, 1991	Virtual	Personal-computer-based flight simulator task made for the PC (1991), (sequel to Falcon/Falson AT). The software is a computer-generated simulation program of the F-16 fighter fixed-wing aircraft. The program is extremely flexible and enables one to modify several parameters of the simulation.	Somewhat Relevant	No, training	Capable	Yes	Missing Info	Missing Info	Missing info	No	Small

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31	Infantry	Full Spectrum Commander	Pandemic®	Virtual	Full Spectrum Warrior is a squad-based, tactical action game that focuses on critical decision making by the Squad Leader (the player). The game is based on a light Infantry training simulator designed by Pandemic Studios for the U.S. Army as a tool to reinforce Army doctrine and team effort among troops, simulating today's urban combat, peace-enforcement, and peacekeeping missions. Full Spectrum Warrior delivers a level of realism and accuracy that has never been seen in a military-based game.	Somewhat Relevant	No, video game	No	Missing Info	No	No	Missing info	No	Scaleable, upto medium
32	Command and Control	IPME, Simulation-based Naval Command and Control Team-design	TNO Human Factors, Holland	Constructive	This document investigated whether changes in the team organization could enable reduced manning. A modeling and simulation environment was developed that can establish and visualize the workload levels of team members during mission completion. The modeling and simulation environment enables the exploration of alternative work and team arrangements and allows evaluations of different manning concepts. The Integrated Performance Modeling Environment (IPME) simulation environment was used to test different new organizational structures by measuring the workload of the individual team members and the overall team workload.	Somewhat Relevant	Yes	Capable	Capable	Capable	Capable	Capable	Capable	Scaleable
33	Naval	Joint Strike Fighter Full-Mission Simulator	Boeing	Virtual	The Integrated Technology Development Laboratories (ITDL) provides core simulation capabilities to support analysis and valuation of future weapon systems for effectiveness in a battlefield environment. It is specifically dedicated to the design and evaluation of high-performance aircraft, including surveillance and command and control aircraft, and the systems that support them.	Somewhat Relevant	Applicable	No	Yes	No	No	Yes	Capable	Small
34	Air	Longbow 2, Helicopter flight simulator	Apache	Virtual	PC-based helicopter flight simulator, modified for a three-person team. Conducting attack missions in challenging battlefields.	Somewhat Relevant	No	Capable	Capable	No	No	Yes	Missing Info	Small
35	Medical	Medical Simulation Centre	Rhode Island Hospital	Virtual	The primary goal of the centre is to improve interdisciplinary team performance. People who function in teams need to be trained as teams. The major component of this platform is a computer controlled "patient", anatomically correct rubberized mannequin. It presents medical teams with all of the vital signs, including pupils that react to light, and lung and heart sounds. This patient even groans.	Somewhat Relevant	No, training facility for medical staff	Capable	Yes	Yes	No	No	Yes	Scaleable
36	Command and Control	Reconfigurable Tactical Operations Simulator	SAIC	Live and Virtual	The U.S. Army, German Air Force (GAF) and Japanese Air Self-Defense Force (JASDF) have used the RTOS to conduct Analyses in Multiple Areas: Capability Evaluation, Proof of Concept, Software Evaluation, Validation Test, Operator Performance, Deployment Analysis, Effectiveness Analysis, and Requirements Development. Tactical Simulation Model Supports Simple Modification of: Surveillance and Radar, Jamming, Missile, Display, Tracking, Launcher, Command and Control, IFF, Data Links, Engagement Decision, Weapons Assignment	Somewhat Relevant	No, Training and operator performance analysis	Capable	Yes	No	Yes	Yes	Missing Info	Medium
37	Air Force	Rotorcraft Flight Simulation	Boeing	Virtual	The FSL can simultaneously fly two real-time pilot-in-the-loop simulations autonomously or networked together for air-to-air or formation flying.	Somewhat Relevant	No, Training	No	No	No	Yes	Yes	No	Small
38	Surgical	SimTech, METI	Swedish Learning Lab and Stanford University	Virtual	The goal of this project is to examine the use of simulation technologies to reduce the incidence of medical errors through the medical training process. This project aims to develop a 3D World (VR) simulation exercise for team learning in critical care management and to compare it's usefulness with a well-established simulation technology for critical care management—the METI human patient simulator (HPS) system. The METI system includes a human size mannequin, connected to a computer, real OR monitors, and an anaesthesia machine. Cardiac function, breath sounds, oxygen saturation, pupil size and more physiological functions are registered. A team consisting of anaesthesiologist, anaesthetist nurse, attending surgeons, technicians etc manage a scenario, and performance is constantly videotaped for a subsequent debriefing.	Somewhat Relevant	No, examine the use of simulation technologies to reduce incidence of medical error through the medical training process	Capable	Yes	No	No	No	Missing info	Small
39	Air, land, sea, and spac	STRIVE CGF	CAE	Constructive and Virtual	STRIVE™ CGF is a high fidelity, full function synthetic tactical environment and computer generated forces package. It is CAE's next-generation synthetic tactical environment and computer-generated forces (CGF) package. It is an off-the-shelf software product that simulates a real-time virtual battlefield for air, land, sea, and space applications.	Somewhat Relevant	No, Other	Missing Info	Capable	No	Capable	Yes	Missing Info	Missing Info
40	Military General	Synthesized Immersion Research Environment (SIRE)	U.S. Air Force Research Laboratory	Virtual	The SIRE is a general-purpose research environment that can be configured to support applied research regarding the design of advanced human-vehicle interfaces, including aircraft and ground vehicles. One research station within the SIRE includes a 40-foot diameter domed visual presentation and integrated spatial audio presentations and head-mounted displays. The second research station is similar to the first with the a 12-foot cube substituting for the 40-foot dome. Both stations currently incorporate F-16 cockpit shells with advanced in-cockpit display hardware.	Somewhat Relevant	No, primary purpose is design of advanced human-vehicle interfaces	No	Capable	No	Yes	Yes	Yes	Small

Ref #	Domain	Platform	Organization	Category	Description	Relevance	Primary Purpose for Team Research	Ad Hoc	Interdisciplinary	Interagency	Joint	Distributed	Teams of Teams	Size of Team
41	Radar	TeamSim (Team Event-Based Adaptive Multilevel Simulation) Radar Task	Missing Info	Virtual	TeamSIM is a PC-based radar-tracking task. Three-person teams were seated at simulated radar consoles where contacts with different priorities and patterns of movement appeared.	Somewhat Relevant	Yes, a dynamic, PC-based, radar tracking simulation designed for the study of individual and team adaptive performance.	Capable	Yes	No	No	Missing info	Missing info	Small
42	Military General	The Archimedes Combat Modeling Platform	Least Squares Software LLC	Constructive	The Archimedes Combat Modeling Platform is a simulator system based on ideas developed from research into the behavior of complex systems. The goals of Archimedes, and more broadly of its sponsor, The United States Marine Corps Combat Development Commands' Project Albert, is that it be able to represent the intangibles of combat and that it capture the nonlinearity intrinsic to battlefield situations. Intangibles include the roles of discipline, cohesion, morale and personality. Archimedes is based on the paradigm of Agent based modeling (ABM). This approach breaks a problem down into constituent elements, called Agents. Archimedes is based on a general high-level ABM software framework called the Behaviour Action Simulation Platform (BASP). Agents are autonomous software units that work independently towards some goal (which may involve cooperating with other Agents). Guided by the ideas of operational synthesis, Archimedes was designed first to be as flexible as possible in order to represent a broad variety of missions.	Somewhat Relevant	No, primarily used for research	No	No	No	No	No	Yes	Small
43	Mine Hunting	The Cirrus Mine Hunting Simulation System (MHSS)	Australian Department of Defence	Virtual	The Cirrus Mine Hunting Simulation System (MHSS) has been developed in close cooperation with the Royal Australian Navy to provide costs effective simulation training in mine hunting. Emulation of sonar consoles supports basic familiarisation of students in the control of their ship-fit minehunting sonar and associated tactical data management system. The training network of 10 consoles facilitates the bulk training of personnel.	Somewhat Relevant	No, Simulation training in mine hunting	Capable	No	No	No	No	Yes	Small
44	Command and Control	Trident Command And Control Team Trainer	NAVAIR Orlando, Training Systems Division	Virtual	The TRIDENT Command and Control Team Trainer (CCTT) enhances the attack centre team's ability to perform the TRIDENT's mission. Realistic simulated scenarios provide immediate feedback on performance. Part of NAVAIR	Somewhat Relevant	No, training	Capable	Yes	No	No	Capable	Yes	Missing info
45	Military General	Defence Modeling and Simulation Office (DMSO)	United States Department of Defence	Organization	The Defence Modeling and Simulation Office (DMSO) is the catalyst organization for Department of Defence (DoD) modeling and simulation (M&S) and ensures that M&S technology development is consistent with other related initiatives.		NA	NA	NA	NA	NA	NA	NA	NA
46	Air Force	FAA, Individual and Team Performance Assessment	Federal Aviation Agency	Organization	This laboratory performs lab and field research to identify the cognitive strategies and processes underlying skill acquisition through training. It evaluates the efficiency and efficacy of training programs, processes, and/or paradigms on the development and enhancement of skills performance required in aviation occupations. Furthermore, it investigates methods for measurement of individual and team performance to support programmatic evaluation of training curricula and innovations for aviation technical, administrative, and managerial personnel.		NA	N/A	N/A	N/A	N/A	N/A	N/A	N/A
47	Space	NASA Ames' Simulation Laboratories - or "SimLabs"	NASA	Facility	NASA Ames' Simulation Laboratories - or "SimLabs" - are comprised of three facilities. The Vertical Motion Simulator (VMS) is the world's largest motion-based simulator and can simulate a variety of vehicles, either currently existing or at the conceptual stage. The Crew-Vehicle Systems Research Facility (CVSRF) specializes in human factors work and houses a Boeing 747-400 simulator, an Advanced Concepts Flight Simulator (ACFS), and an Air Traffic Control simulator. FutureFlight Central (FFC) is a simulated air traffic control tower that can also be used as a visualization tool for other types of visual databases.		NA	NA	NA	NA	NA	NA	NA	NA
48	Air Force	Organization	NAVAIR, Orlando	N/A	NAVAIR Orlando has comprehensive simulation and training systems responsibilities ranging from research and technology base development through system acquisition and life cycle support.		NA	NA	NA	NA	NA	NA	NA	NA
49	Military General	Simulation Operations Functional Area 57	US Department of the Army	N/A	A Simulation Operations (FA57) officer is first an operator, and then a simulationist. As the SME on Battle Command and Simulations the FA 57 officer applies models and simulations to create the environment that prepare soldiers, leaders and units for war. FA57 officers plan and employ a mix of live, virtual and constructive simulations in support of training and military operations. FA57 officers integrate modeling and simulation with battle command systems.		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
50	Military General	Synthetic Environment Based Acquisition (SEBA)	United Kingdom	Organization	The acquisition of Synthetic Environments within the UK Ministry of Defence (MoD) is known as Synthetic Environment Based Acquisition (SeBA) and is defined as the 'consistent and coherent application of modelling, simulation and SE technology within, and across, both acquisition phases and programmes to facilitate the attainment of the Smart Acquisition goals of faster, cheaper, better'		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
51	Military, Industry and Academia	Synthetic Environments National Advisory Committee	United Kingdom	Organization	The Synthetic Environment National Advisory Committee (SE NAC) is a joint Government, Academia and Industry group which provides a focus for SE activity in the UK and develops and implements combined Government & Industry strategy and policy.		N/A	NA	NA	NA	NA	NA	NA	NA
52	Military General	United States Joint Forces Command (USJFCOM)	US Department of Defense	Organization	USJFCOM uses many advanced technical methods to simulate military operations as part of its joint force trainer and experimentation missions. Modeling and simulations, or "M&S", describes the use of realistic computer-generated battlefield models and other types of simulation support that can be used to augment the training of a joint force staff.		N/A	NA	NA	NA	NA	NA	NA	NA

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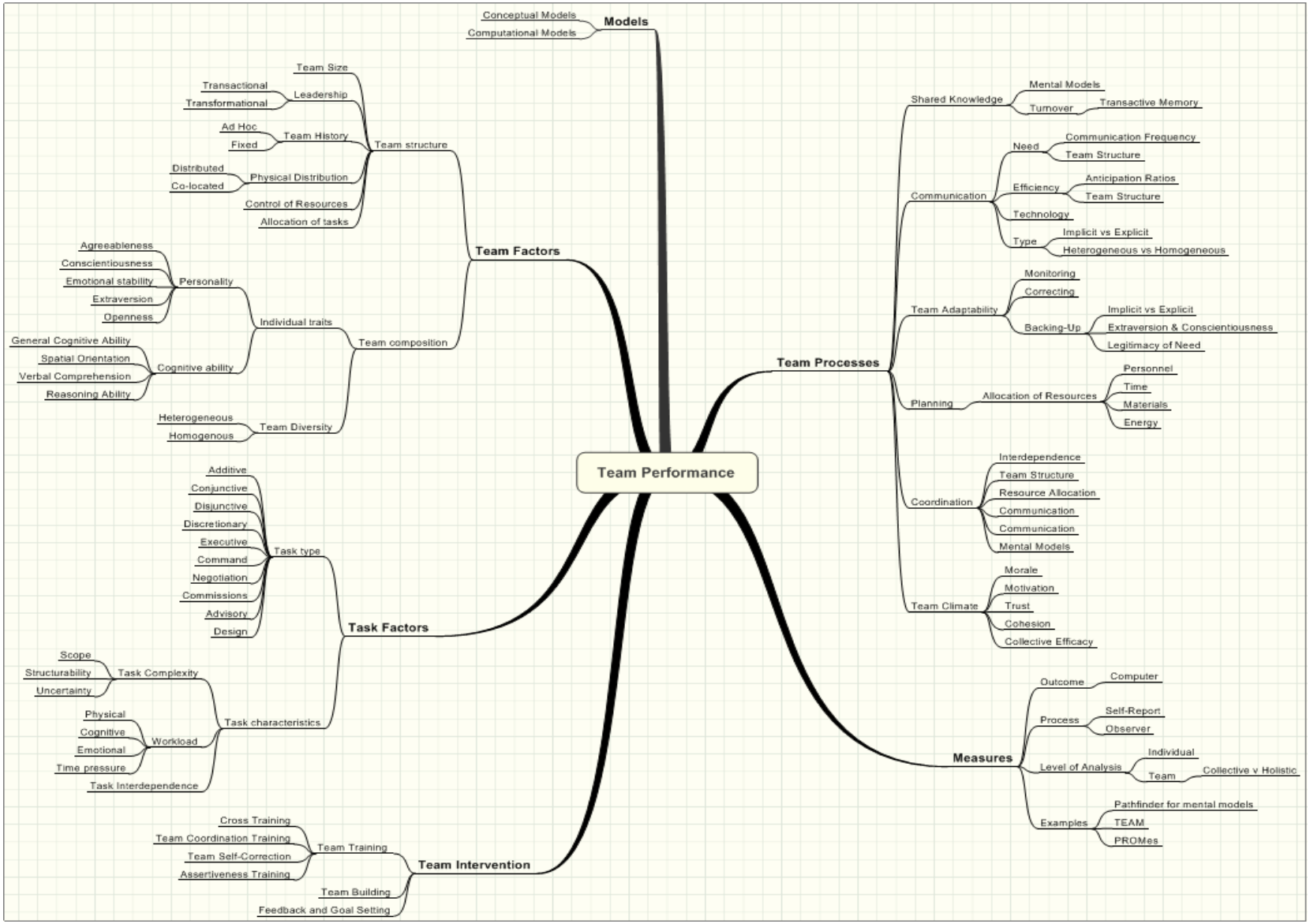
Annex C: Mindmap of Team Research Issues (Sartori et al, 2006)

HUMANSYSTEMS
Incorporated


Team Performance
Models
Conceptual Models
Computational Models
Team Factors
Team structure
Team Size
Leadership
Transactional
Transformational
Team History
Ad Hoc
Fixed
Physical Distribution
Distributed
Co-located
Control of Resources
Allocation of tasks
Team composition
Individual traits
Personality
Agreeableness
Conscientiousness
Emotional stability
Extraversion
Openness
Cognitive ability
General Cognitive Ability
Spatial Orientation
Verbal Comprehension
Reasoning Ability
Team Diversity
Heterogeneous
Homogenous
Task Factors
Task type
Additive
Conjunctive
Disjunctive
Discretionary
Executive
Command
Negotiation
Commissions
Advisory
Design
Task characteristics
Task Complexity
Scope
Structurability
Uncertainty
Workload
Physical
Cognitive
Emotional
Time pressure
Task Interdependence
Team Intervention
Team Training
Cross Training
Team Coordination Training
Team Self-Correction
Assertiveness Training
Team Building
Feedback and Goal Setting
Team Processes
Shared Knowledge
Mental Models
Turnover
Transactive Memory
Communication
Need
Communication Frequency
Team Structure
Efficiency
Anticipation Ratios
Team Structure
Technology
Type
Implicit vs Explicit
Heterogeneous vs Homogeneous
Team Adaptability
Monitoring
Correcting
Backing-Up
Implicit vs Explicit
Extraversion & Conscientiousness
Legitimacy of Need
Planning
Allocation of Resources
Personnel
Time
Materials
Energy
Coordination
Interdependence
Team Structure
Resource Allocation
Communication
Communication
Mental Models
Team Climate
Morale
Motivation
Trust
Cohesion
Collective Efficacy
Measures
Outcome
Computer
Process
Self-Report
Observer
Level of Analysis
Individual
Team
Collective v Holistic
Examples
Pathfinder for mental models
TEAM
PROMes

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(U) Defence Research and Development Canada (DRDC) Toronto is in the process of developing a team research platform aimed at supporting the Canadian Forces (CF) future integrated operations, and interoperability with allies, other government departments (OGDs) and non−government organizations (NGOs). A literature review of platforms for team research was conducted to support the Crown in choosing a specific type of team in a specific work context as the focus of team research and team modelling to be conducted in a multi−year Applied Research Project (ARP). The objectives of this report were to identify and characterize different team research platforms in support of military operations (or related applications), review the different team research platforms in terms of criteria identified by the team literature review; and identify requirements for a new experimental platform that will support experiments that are representative of the targeted teamwork context. In addition, correlations were established with the literature review that was also conducted in the first phase of this project (Sartori, Waldherr and Adams, 2006), to identify areas that are relatively unexplored in both the literature and platform review.

A series of publicly available literature databases and other readily accessible sources of information were searched based on specified keywords for the platform literature review. This review proved to be a valuable task to produce recommendations for a new team research platform. This was achieved by identifying commonalities and unique features between the capabilities of different types of platforms. From the main findings of this study, it was concluded that the new team research platform should: support the following team types – ad hoc, interdisciplinary, interagency, joint, distributed and teams−of−teams, be medium fidelity, be a virtual simulation with some constructive capabilities, use an operational/strategic level of activity, use small team sizes, address team diversity, address different types of workload (physical, cognitive, and time pressure), be amenable to upgrades and future expansions (open architecture), address and measure team processes such as shared knowledge, communication, and planning, be amendable to the study of individual performance or behaviour, be amenable to customization of the interface, have the capability to manipulate task loads, and have the capability to create a user−defined environment.

14. KEYWORDS, DESCRIPTORS or IDENTIFIERS (Technically meaningful terms or short phrases that characterize a document and could be helpful in cataloguing the document. They should be selected so that no security classification is required. Identifiers, such as equipment model designation, trade name, military project code name, geographic location may also be included. If possible keywords should be selected from a published thesaurus, e.g. Thesaurus of Engineering and Scientific Terms (TEST) and that thesaurus identified. If it is not possible to select indexing terms which are Unclassified, the classification of each should be indicated as with the title.)

(U) team performance, platforms, testbeds, experiments, simulation